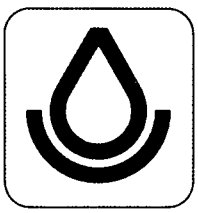
SOIL SURVEY OF

Guadalupe County, Texas



United States Department of Agriculture
Soil Conservation Service

In cooperation with
Texas Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in the period 1965–72. Soil names and descriptions were approved in 1973. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Comal-Hays-Guadalupe Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Guadalupe County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification, range site, and gardening and landscaping suitability group of each. It also shows the page where each soil is described and the page for the capability group and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife Habitat."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the sections "Engineering Uses of the Soils" and "Use of the Soils for Recreational Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Guadalupe County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "General Nature of the County."

Contents

Issued March 1977

Summary of Tables

SOIL SURVEY OF GUADALUPE COUNTY, TEXAS

BY ROBERT N. RAMSEY AND NORMAN P. BADE, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE,
IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

GUADALUPE COUNTY is in south-central Texas (fig. 1). It is bordered on the north by Comal County and Hays County, on the west by Bexar County, on the south by Wilson County, and on the east by Gonzales and Caldwell Counties. Seguin, the county seat, is on U.S. Highway 90 near Interstate Highway 10, about 36 miles east of San Antonio and 160 miles west of Houston.

The county covers 715 square miles or 458,240 acres. Farming is the major enterprise. Cotton, corn, grain sorghum, oats, peanuts, watermelons, and pecans are the principal crops. Cattle, hogs, and poultry are also produced. Industries include oil production, the manufacture of steel products, fiberglass, radios, cotton goods flour, brick, auto parts, furniture, sporting goods, and poultry processing. Fishing, swimming, and water sports add to the economy.

The terrain of the county is nearly level to rolling. Elevations range from 300 to 900 feet. The county is bisected by the Guadalupe River. The soils range from deep clays in the northern half of the county to deep sandy loams and sands in the southern half.

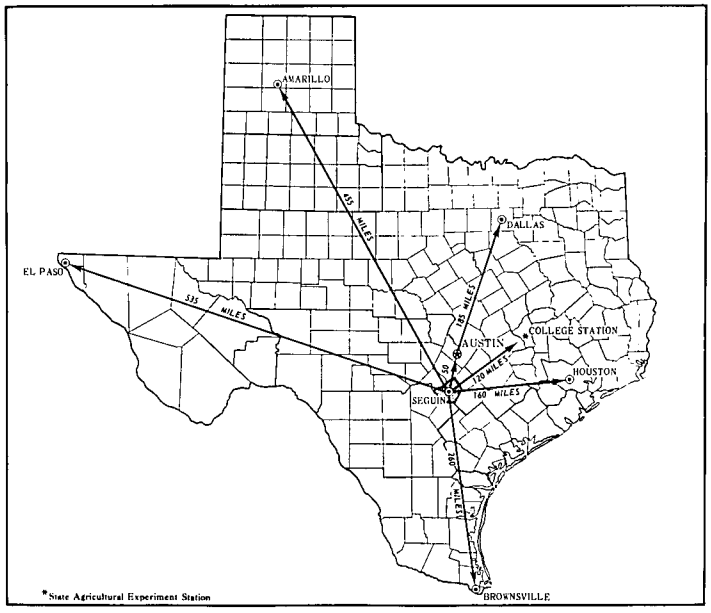


Figure 1.—**Location of Guadalupe County in Texas.**

There is a trend toward the conversion of cropland to improved grassland. This conversion is generally taking place on soils that are low in fertility and eroded. Brush encroachment is becoming a major concern. Income-producing recreation, in the form of hunting, fishing, and camping, is becoming popular throughout the county. Many farms are owned by individuals or by groups in San Antonio or Houston.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Guadalupe County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Seguin and Vernia, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into

phases. The name of a soil phase indicates a feature that affects management. For example, Houston Black gravelly clay, 1 to 3 percent slopes, is one phase within the Houston Black series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Guadalupe County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Nebgen-Jebb complex, 3 to 20 percent slopes, is the only soil complex mapped in Guadalupe County.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Bosque and Seguin soils, frequently flooded, is an example.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory meaurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Guadalupe County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing watershed, range, or wildlife areas; or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Guadalupe County are described in the following pages.

1. Crockett-Demona-Windthorst Association

Deep, moderately well drained, gently sloping to sloping, loamy to sandy soils on uplands

This association is on broad upland ridges and narrow valleys and drainageways (fig. 2). Many abandoned fields and pastures are infested with mesquite and other brush, and the association is known locally as "mesquite land."

This association makes up about 33 percent of the county. It is about 40 percent Crockett soils, 20 percent Demona soils, 14 percent Windthorst soils, and 26 percent Mabank, Darst, Vernia, and Uhland soils.

Demona soils are in valleys and drainageways. Crockett and Windthorst soils are on ridges. Small areas of Mabank, Darst, and Vernia soils are also on ridges, and small areas of Uhland soils are on bottom lands.

Crockett soils have a surface layer of brown fine sandy loam about 8 inches thick. The next layer, about 54 inches thick, is mottled clay in the upper part and mottled sandy clay in the lower part.

Demona soils have a surface layer of loamy fine

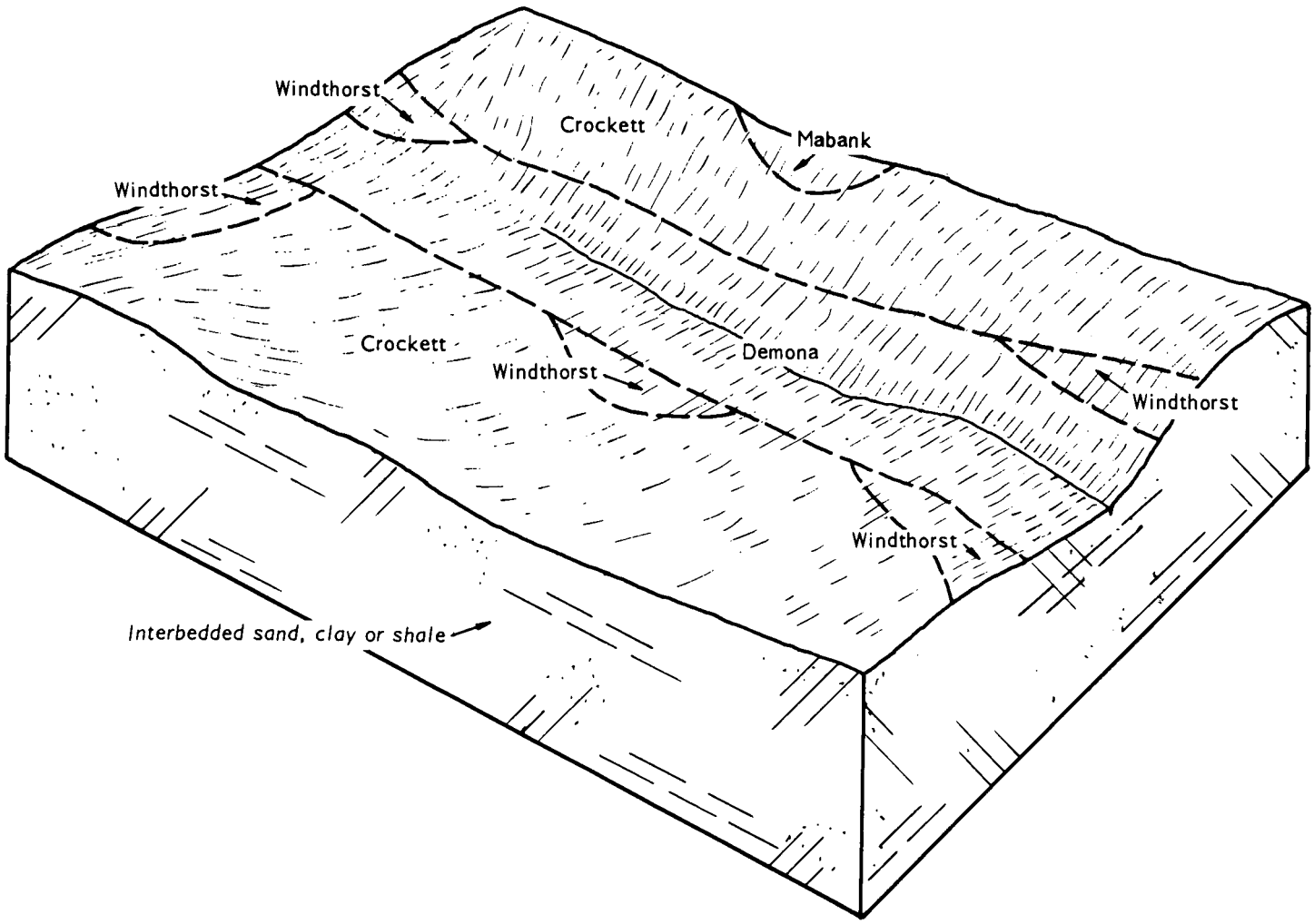


Figure 2.—**Typical pattern of soils and underlying material in association 1.**

sand about 24 inches thick. It is pale brown in the upper part and very pale brown in the lower part. The next layer, more than 36 inches thick, is mottled clay in the upper part and mottled sandy clay in the lower part.

Windthorst soils have a surface layer of yellowish-brown fine sandy loam about 8 inches thick. The next layer, to a depth of 72 inches, is mottled clay in the upper part and mottled sandy clay loam in the lower part.

This association is mainly abandoned fields, but some areas are used for improved pasture and some are used for cultivated crops. Gravelly areas are scattered throughout the association. Brush infestation is a concern. The soils in the association are suited to improved pasture when brush is controlled. They have severe limitations for septic-tank absorption fields. The shrink-swell potential is moderate to high in the lower layers.

2. Branyon-Barbarosa-Lewisville Association

Deep, moderately well drained to well drained, nearly level to gently sloping, clayey soils on stream terraces

This association is on broad, smooth, ancient terraces that are dissected in places by small creeks and drainageways (fig. 3).

This association makes up about 23 percent of the county. It is about 52 percent Branyon soils, 18 percent Barbarosa soils, 13 percent Lewisville soils, and 17 percent Trinity, Queeny, and Burleson soils.

Branyon soils are mainly in large, smooth areas. Barbarosa and Lewisville soils are on broad, low ridges. Small spots of Burleson soils are also in the large, smooth areas, small spots of Queeny soils are on ridges, and areas of Trinity soils are in flood plains of the creeks.

Branyon soils have a surface layer of very dark gray clay about 52 inches thick. The next layer, about 12 inches thick, is gray clay in the upper part and very pale brown clay in the lower part.

Barbarosa soils have a surface layer of very dark grayish-brown silty clay about 24 inches thick. The next layer, about 48 inches thick, is reddish-brown clay in the upper part and reddish-yellow clay in the lower part.

Lewisville soils have a surface layer of dark grayish-brown silty clay about 13 inches thick. The next layer, about 47 inches thick, is brown silty clay in the upper part, yellowish-brown silty clay in the middle part,

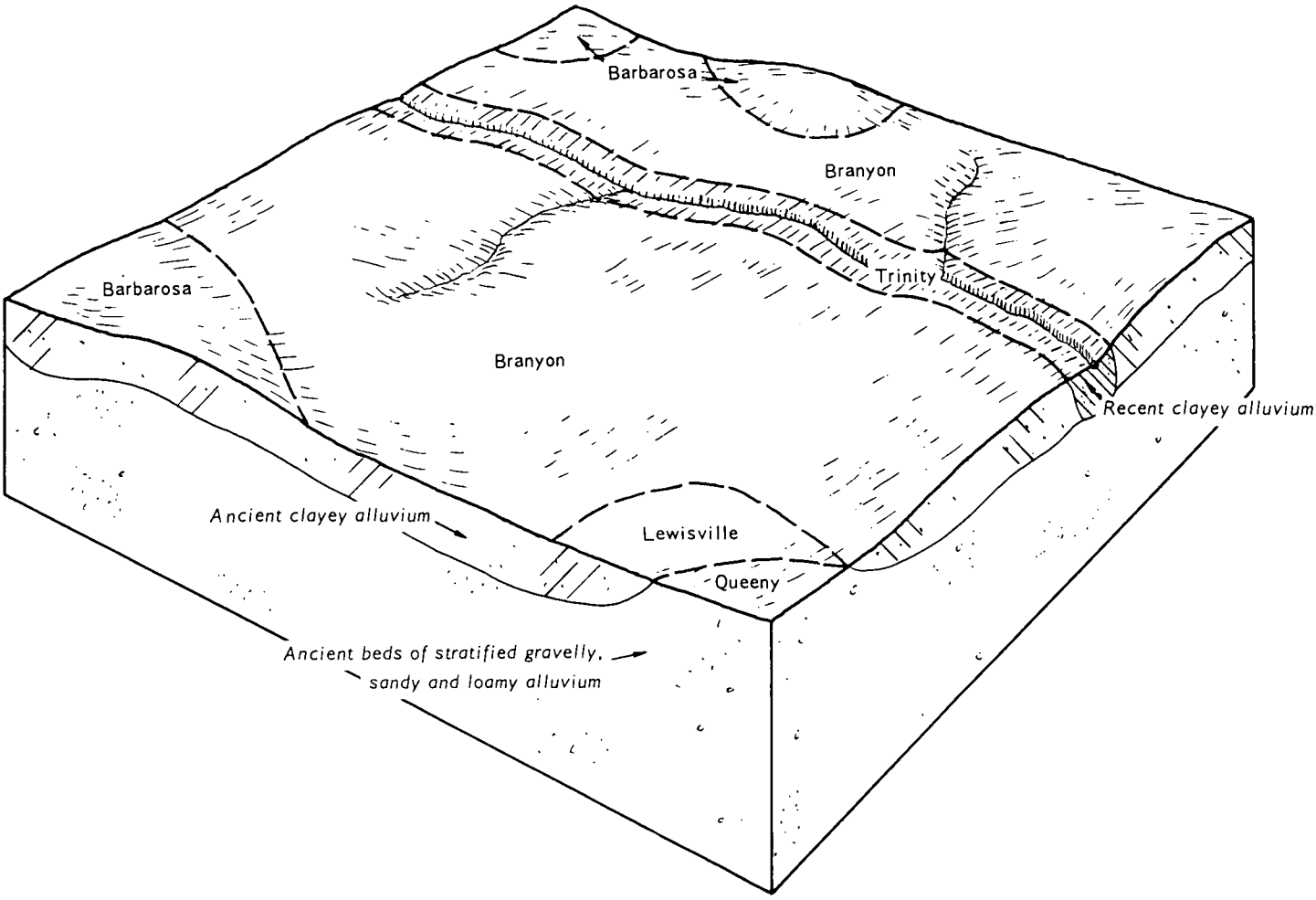


***Figure 3.*—Typical pattern of soils and underlying material in association 2.**

and light yellowish-brown silty clay loam in the lower part.

This association is used mainly for crops and is well suited to this use. It is suitable for irrigation. The soils in this association have moderate to severe limitations for septic-tank absorption fields. The shrink-swell potential is high to very high. Some areas are suitable as sources of gravel below a depth of about 6 feet.

3. Houston Black-Heiden Association

Deep, moderately well drained to well drained, gently sloping to moderately steep, clayey soils on uplands

This association is on rolling, broad ridges and in valleys and on hills in steeper areas (fig. 4).

This association makes up about 22 percent of the county. It is about 52 percent Houston Black soils, 29 percent Heiden soils, and 19 percent Trinity, Ferris, and Altoga soils.

Houston Black soils are mainly on ridges and in valleys. Heiden soils are mainly on sides of hills. Small areas of Trinity soils are on the flood plains of creeks, and small areas of Ferris and Altoga soils are on hills.

Houston Black soils have a surface layer of very dark gray clay about 36 inches thick. The next layer, to a depth of about 60 inches, is olive-gray clay in the upper part and olive clay in the lower part.

Heiden soils have a surface layer of dark grayish-brown clay about 25 inches thick. The next layer, about 39 inches thick, is olive clay.

This association is used mainly for crops and improved pasture. Many sloping, eroded areas are being converted from crops to improved pasture. The soils in the association have severe limitations for septic-tank absorption fields. The shrink-swell potential is very high. Gravelly areas are scattered throughout the association.

4. Patilo-Arenosa Association

Deep, well drained to moderately well drained, gently sloping to sloping, sandy soils on uplands

This association is on low, hummocky hills and in narrow valleys (fig. 5). The association is locally known as "the sandhills."

This association makes up about 13 percent of the county. It is about 42 percent Patilo soils, 28 percent Arenosa soils, and 30 percent Nebgen and Jedd soils.

Patilo soils are mainly on the middle and lower

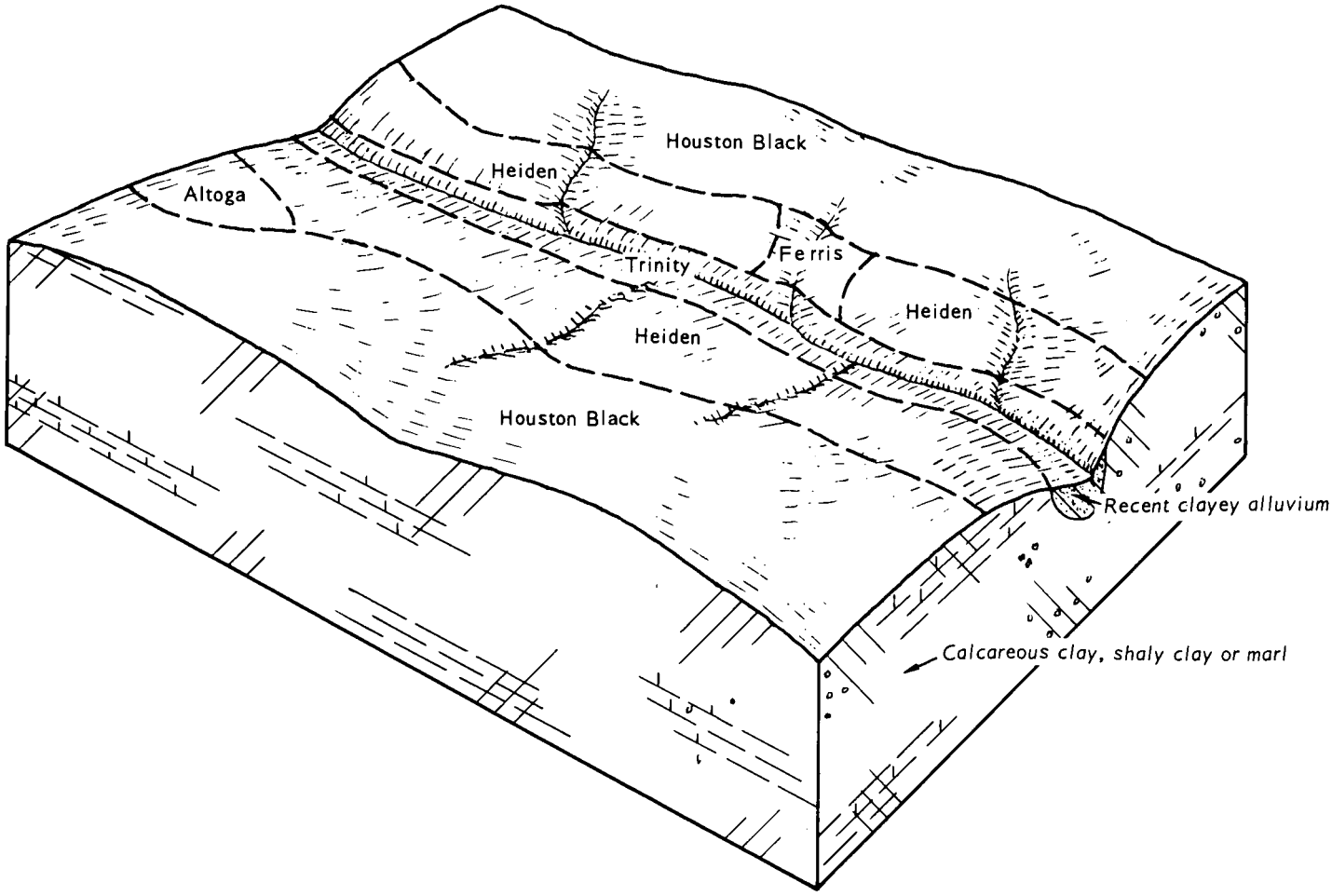


Figure 4.—**Typical pattern of soils and underlying material in association 3.**

parts of hills, and Arenosa soils are on the middle and upper parts. Small areas of Nebgen and Jedd soils are on narrow ridges.

Patilo soils have a surface layer about 52 inches thick. It is light brownish-gray fine sand in the upper part and very pale brown fine sand in the lower part. The next layer, to a depth of 84 inches, is mottled sandy clay loam.

Arenosa soils have a surface layer of pale-brown fine sand about 8 inches thick. It is underlain, to a depth of 96 inches, by very pale brown fine sand.

This association is used mainly for native range and for recreation, and some cleared areas are used for improved pasture. It is better suited to these uses than it is to others. The soils in this association have slight limitations for septic-tank absorption fields. The shrink-swell potential is very low.

5. Sunev-Seguin Association

Deep, well-drained, nearly level to gently sloping, loamy soils on bottom lands and terraces

This association is on smooth flood plains and terraces.

The association makes up about 7 percent of the county. It is about 32 percent Sunev soils, 20 percent Seguin soils, and 48 percent Queeny and Bosque soils.

Seguin soils are on flood plains, and Sunev soils are on low terraces. Small areas of Queeny soils are on ridges and breaks of the terraces, and Bosque soils are on flood plains.

Sunev soils have a surface layer of dark grayish-brown loam about 12 inches thick. The next layer, to a depth of 72 inches, is brown loam in the upper part and very pale brown loam in the lower part.

Seguin soils have a surface layer of dark grayish-brown silty clay loam about 13 inches thick. The next layer, to a depth of 62 inches, is silty clay loam. It is grayish brown in the upper part and light brownish gray in the lower part.

This association is used for recreation, pecan production, improved pasture, and crops and is well suited to these uses. It is suitable for irrigation. The soils in this association generally have slight limitations for septic-tank filter fields, but in areas subject to frequent flooding the limitations are severe. The shrink-swell potential is low to moderate.

6. Austin-Eddy Association

Moderately deep to very shallow, well-drained, gently sloping, clayey to gravelly loamy soils on uplands

This association is on broad, smooth ridges that have narrow valleys and drainageways.

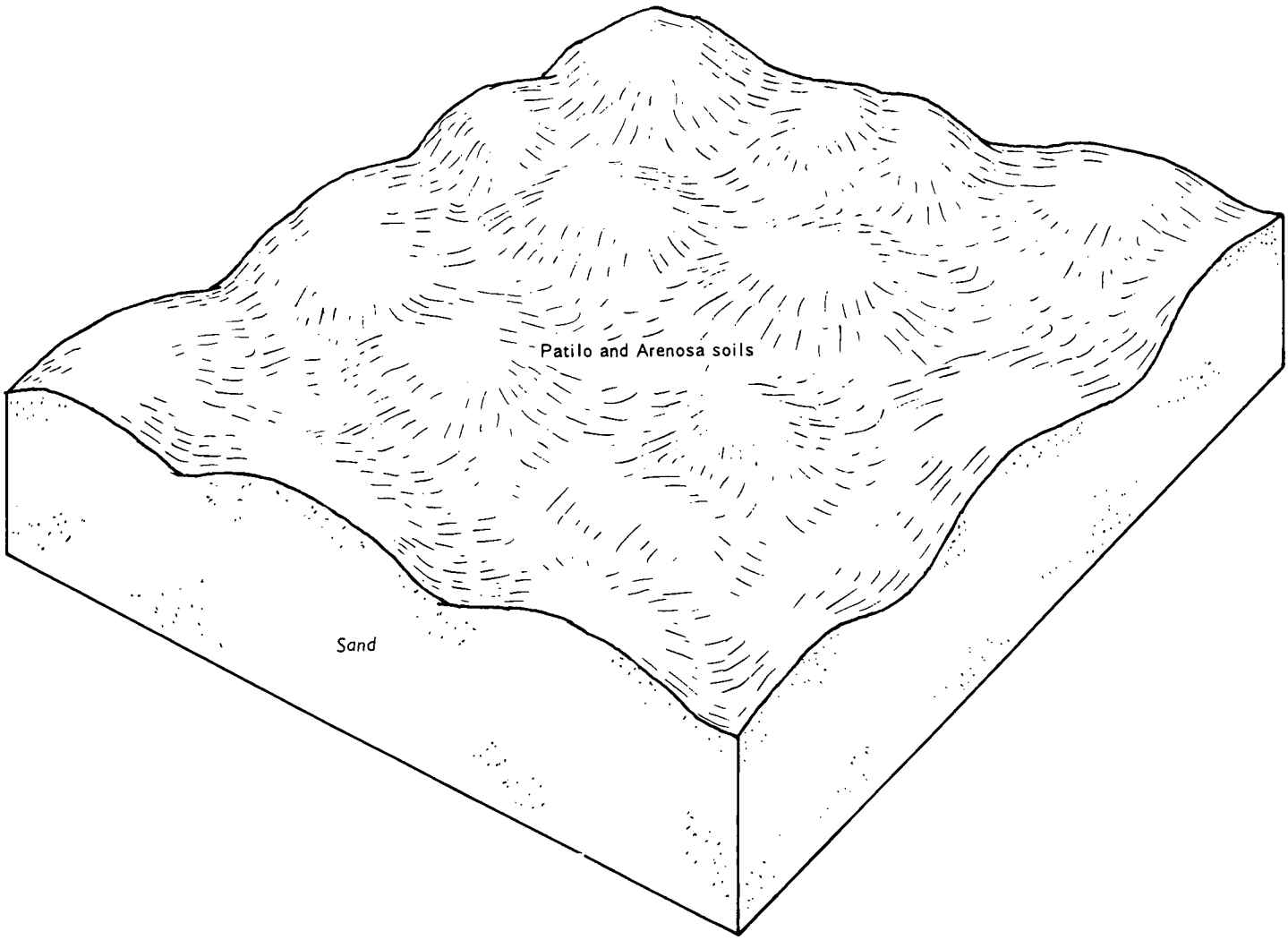


Figure 5.—Typical pattern of soils and underlying material in association 4.

This association makes up about 2 percent of the county. It is about 40 percent Austin soils, 19 percent Eddy soils, and 41 percent Doss, Altoga and Houston Black soils.

Austin soils are mainly on gently sloping tops of ridges. Eddy soils are on sloping sides of ridges. Small areas of Doss and Altoga soils are on ridges, and small areas of Houston Black soils are in valleys and drainageways.

Austin soils have a surface layer of dark grayish-brown silty clay about 18 inches thick. The next layer, about 10 inches thick, is brown silty clay. The next lower layer, about 14 inches thick, is very pale brown silty clay loam. The underlying material, below a depth of about 42 inches, is white platy chalk.

Eddy soils have a surface layer of grayish-brown gravelly clay loam about 4 inches thick that is underlain by white platy chalk.

This association is used mainly for suburban development, but a few areas are used for crops and native range. Much of the association has scattered live oak trees and is very desirable for home sites. The soils of the association have severe limitations for septic-tank absorption fields because the depth to chalk is shallow. The shrink-swell potential is low to high.

Descriptions of the Soils

This section describes the soil series and mapping units in Guadalupe County. Each soil series is described in detail, and then, briefly, each mapping unit in that series is described. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Altoga silty clay, 3 to 5 percent slopes, eroded	1,460	0.3	Heiden clay, 5 to 8 percent slopes, eroded	3,660	0.8
Altoga silty clay, 5 to 12 percent slopes, eroded	1,090	.2	Houston Black clay, 0 to 1 percent slopes	1,040	.2
Arenosa fine sand, 1 to 8 percent slopes	5,420	1.2	Houston Black clay, 1 to 3 percent slopes	38,020	8.3
Austin silty clay, 1 to 3 percent slopes	1,890	.4	Houston Black gravelly clay, 1 to 3 percent slopes	2,540	.6
Austin silty clay, 3 to 5 percent slopes, eroded	1,890	.4	Houston Black gravelly clay, 3 to 5 percent slopes	10,840	2.4
Barbarosa silty clay, 0 to 1 percent slopes	14,550	3.2	Lewisville silty clay, 0 to 1 percent slopes	8,410	1.8
Barbarosa silty clay, 1 to 3 percent slopes	5,340	1.2	Lewisville silty clay, 1 to 3 percent slopes	6,080	1.3
Bosque and Seguin soils, frequently flooded	6,350	1.4	Mabank loam, 0 to 1 percent slopes	1,840	.4
Branyon clay, 0 to 1 percent slopes	45,614	9.9	Mabank loam, 1 to 3 percent slopes	8,970	2.0
Branyon clay, 1 to 3 percent slopes	10,380	2.3	Mabank loam, 1 to 3 percent slopes, eroded	1,710	.4
Burleson clay, 0 to 1 percent slopes	870	.2	Nebgen-Jedd complex, 3 to 20 percent slopes	2,330	.5
Burleson gravelly clay, 0 to 1 percent slopes	1,130	.2	Patilo and Arenosa soils, 1 to 8 percent slopes	51,680	11.2
Burleson gravelly clay, 1 to 3 percent slopes	2,530	.6	Queeny gravelly loam, 1 to 5 percent slopes	5,980	1.3
Crockett fine sandy loam, 0 to 1 percent slopes	1,470	.3	Queeny gravelly loam, 5 to 20 percent slopes	2,320	.5
Crockett fine sandy loam, 1 to 3 percent slopes	18,680	4.1	Quihi soils, 1 to 5 percent slopes	1,090	.2
Crockett gravelly sandy loam, 1 to 5 percent slopes	7,230	1.5	Seguin silty clay loam	4,890	1.1
Crockett loam, 2 to 5 percent slopes, eroded	31,280	6.8	Sunev loam, 0 to 1 percent slopes	5,770	1.3
Crockett loam, 3 to 8 percent slopes, severely eroded	3,830	.8	Sunev loam, 1 to 3 percent slopes	2,470	.5
Darst very gravelly sandy loam, 5 to 10 percent slopes	3,470	.8	Sunev loam, 3 to 5 percent slopes, eroded	2,100	.5
Demona loamy fine sand, 1 to 5 percent slopes	31,580	6.9	Trinity clay	7,400	1.6
Doss silty clay, 1 to 3 percent slopes	1,210	.3	Trinity clay, frequently flooded	11,680	2.5
Eddy gravelly clay loam, 3 to 5 percent slopes	1,820	.4	Uhland fine sandy loam, occasionally flooded	1,720	.4
Ferris and Heiden soils, 5 to 20 percent slopes, eroded	8,930	1.9	Uhland soils, frequently flooded	11,380	2.5
Heiden clay, 1 to 3 percent slopes	5,810	1.3	Vernia very gravelly loamy sand, 1 to 5 percent slopes	7,580	1.6
Heiden clay, 3 to 5 percent slopes	4,090	.9	Windthorst fine sandy loam, 1 to 3 percent slopes	2,580	.6
Heiden clay, 3 to 5 percent slopes, eroded	15,480	3.4	Windthorst fine sandy loam, 1 to 5 percent slopes, eroded	19,550	4.3
			Water	1,216	.3
			Total	458,240	100.0

profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Color terms are for dry soil unless otherwise stated. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit.

Preceding the name of each mapping unit is the symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit and range site in which the mapping unit has been placed. The page for the description of each capability unit or range site can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual.[1]

[1] United States Department of Agriculture. Soil Survey Manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus., 1951.

Altoga Series

The Altoga series consists of deep, calcareous, gently sloping to strongly sloping, clayey soils on uplands and ancient stream terraces. These soils formed in calcareous, clayey material.

In a representative profile the surface layer is grayish-brown silty clay about 7 inches thick. The next layer, about 28 inches thick, is light yellowish-brown, firm silty clay in the upper part and very pale brown, firm silty clay in the lower part. It is 5 to 10 percent, by volume, soft masses, threads, and concretions of lime. The underlying material, to a depth of 72 inches, is light-gray silty clay.

Altoga soils are well drained. Runoff is medium to rapid, internal drainage is medium, and permeability is moderate. Available water capacity is high. The hazard of water erosion is moderate to severe.

Representative profile of Altoga silty clay, 3 to 5 percent slopes, eroded, 8 miles west of Seguin on Farm Road 78 to Farm Road 1044, 7 miles north, then 500 feet into pasture west of road:

A1—0 to 7 inches, grayish-brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong, medium, granular, and very fine, subangular blocky structure; hard, firm; few fine roots; few wormcasts; calcuim carbonate equivalent of 56 percent; calcareous, moderately alkaline; clear, smooth boundary.

B2ca—7 to 20 inches, light yellowish-brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; strong, very fine, subangular blocky structure; hard, firm; few fine roots; common wormcasts; about 5 percent, by volume, soft masses of calcium carbonate; calcium carbonate equivalent of 63 percent; calcareous, moderately alkaline; gradual, smooth boundary.

B3ca—20 to 35 inches, very pale brown (10YR 7/4) silty clay, light yellowish brown (10YR 6/4) moist; common, fine, distinct, yellowish-brown mottles; moderate, very fine, subangular blocky structure; hard, firm; about 5 to 10 percent, by volume, soft masses, threads, and concretions of calcium carbonate; calcium carbonate equivalent of 62 percent; calcareous, moderately alkaline; gradual, smooth boundary.

C—35 to 72 inches, light-gray (10YR 7/2) silty clay, light brownish gray (10YR 6/2) moist; few, fine, faint, brownish-yellow mottles; massive; hard, firm; few soft masses of calcium carbonate; calcium carbonate equivalent of 58 percent; calcareous, moderately alkaline.

The solum ranges from 35 to 50 inches in thickness. Clay makes up 35 to 50 percent of the soil material between depths of 10 and 40 inches, but it averages about 40 percent. All horizons are silty clay, silty clay loam, or clay loam. The calcium carbonate equivalent between depths of 10 and 40 inches ranges from 55 to 65 percent.

The A horizon ranges from 3 to 11 inches in thickness. It is grayish brown or light brownish gray. Siliceous pebbles and limestone pebbles are in the soils, and oyster shells and snail shells are on the surface in places.

The Bca horizon ranges from 24 to 39 inches in thickness. It is light brownish gray, pale brown, light yellowish brown, or very pale brown and is mottled in shades of yellow in places.

In the C horizon color is mostly shades of gray, brown, or yellow.

A1C3—Altoga silty clay, 3 to 5 percent slopes, eroded. This gently sloping soil is in long, narrow areas that range from about 20 to 150 acres in size. It is mostly on the tops and sides of hills above areas of Heiden clay. Slopes are convex and single and have a gradient that averages about 4 percent. This soil has the profile described as representative of the series. Water erosion has removed the surface layer in about 30 to 75 percent of most mapped areas. Gullies, about 2 to 6 feet deep, 4 to 10 feet wide and 200 to 500 feet apart, make up about 10 to 20 percent of the mapped areas (fig. 6).

Included with this soil in mapping are spots of Austin, Doss, and Heiden soils. Austin and Doss soils are on ridges above Altoga soils, and Heiden soils are on sides of hills below Altoga soils. The spots are mostly less than 2 acres in size.

The hazard of water erosion is moderate. The soil is mostly abandoned, eroded cropland. A few areas are used for growing grain sorghum and grazing oats. The soil is suited to improved pasture grasses if gullies are shaped, smoothed, and filled. Capability unit IIIe-2; Clay Loam range site.

A1E3—Altoga silty clay, 5 to 12 percent slopes, eroded. This sloping to strongly sloping soil is in areas that range from about 20 to 50 acres in size. Most areas have a long, narrow, curved shape, and slope is toward small creeks and drainageways. A few areas have an oval shape and are on hilltops. Slopes are single and convex and have a gradient that averages about 10 percent. Water erosion has removed the surface layer and part of the next layer in more than 75 percent of the mapped areas. The gullies are 4 to 12 feet deep, 10 to 20 feet wide, and 50 to 100 feet apart. A few small areas, never cultivated, are moderately eroded.

Figure 6.—**Abandoned field of Altoga silty clay, 3 to 5 percent slopes, eroded. This soil is suitable for improved pasture grasses when gullies are shaped, smoothed, and filled.**

The surface layer, where it remains, is light brownish-gray silty clay about 4 inches thick. The next layer about 32 inches thick, is very pale brown, firm silty clay that has masses and concretions of lime in the lower part. It is underlain by light-gray silty clay.

Included with this soil in mapping are a few spots of eroded Ferris and Heiden soils about 3 acres in size. They are in the same position as Altoga soils.

Runoff is rapid. The hazard of water erosion is severe. The soil is mostly abandoned, eroded cropland that is not suited to cultivated crops because of slope and erosion. Some areas are suited to improved pasture grasses if gullies are shaped, smoothed, and filled. Good grazing management is essential to control erosion. Capability unit VIe-1; Clay Loam range site.

Arenosa Series

The Arenosa series consists of deep, noncalcareous, gently sloping to sloping, sandy soils on uplands. These soils formed in thick beds of sand.

In a representative profile the surface layer is pale-brown fine sand about 8 inches thick. It is underlain to a depth of 96 inches by very pale brown, loose, fine sand.

Arenosa soils are well drained. Runoff is very slow, and internal drainage and permeability are very rapid. Available water capacity is low. The hazard of water erosion is slight.

Representative profile of Arenosa fine sand, 1 to 8 percent slopes, 7 miles south of Seguin on Texas Highway 123, 2.5 miles east on paved road past Zion Hill Church, 8 miles south on second unpaved road, then 100 feet into woods east of road:

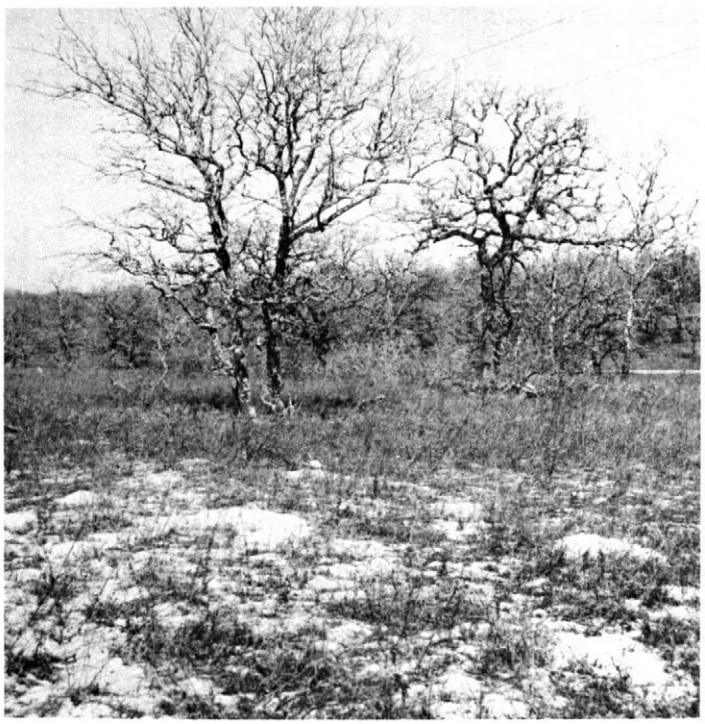


Figure 7.—**Landscape of Arenosa fine sand, 1 to 8 percent slopes. The soil is droughty, and vegetation is thin in many areas.**

A1—0 to 8 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; few fine roots; slightly acid; gradual, smooth boundary.

C1—8 to 84 inches, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots in upper part; few yellowish-brown coatings on sand grains in lower part; medium acid; diffuse, smooth boundary.

C2—84 to 96 inches, very pale brown (10YR 8/3) fine sand, very pale brown (10YR 7/3) moist; single grained; loose; few yellowish-brown coatings on sand grains; medium acid.

The combined sandy A and C horizons are more than 80 inches thick. The A horizon ranges from 4 to 8 inches in thickness. It is pale brown, very pale brown, or light yellowish brown. The C horizon ranges from medium to slightly acid.

ArD—Arenosa fine sand, 1 to 8 percent slopes. This gently sloping to sloping soil is on uplands in areas that range from about 10 to 400 acres in size. Many of the smaller areas have an irregular, oval shape. The larger areas are mostly long and narrow. Slopes are convex. Trees in many areas died in droughty years, and the areas now have a savannah appearance. This soil has the profile described as representative of the series.

Included with this soil in mapping in places are a few spots of Patilo soils in slightly lower positions than Arenosa soils. These spots make up less than 10 percent of any mapped area.

This soil is better suited to native range and recreation than to most other uses. Natural vegetation provides protection and food for wildlife. This soil is not well suited to cultivated crops or improved pasture (fig. 7).

Capability unit IVs–1; Deep Sand Savannah range site.

Austin Series

The Austin series consists of moderately deep, calcareous, gently sloping, clayey soils on uplands. These soils formed in residuum weathered from chalk and marl.

In a representative profile the surface layer is dark grayish-brown, firm silty clay about 18 inches thick. The next layer, about 10 inches thick, is brown, firm silty clay that contains a few soft masses of lime. The next lower layer, about 14 inches thick, is very pale brown silty clay loam. The underlying material, to a depth of 45 inches, is white platy chalk.

Austin soils are well drained. Runoff is slow to medium, internal drainage is medium, and permeability is moderately slow. Available water capacity is high. The hazard of water erosion is moderate.

Representative profile of Austin silty clay, 1 to 3 percent slopes, 16 miles west of Seguin on Farm Road 78 to Cibolo, 7 miles north on Farm Road 1103, 3.5 miles west on Interstate Highway 35, then 600 feet into field south of road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, granular structure; hard, firm; few chalk fragments on surface; calcium carbonate equivalent of 42 percent; calcareous, moderately alkaline; clear, smooth boundary.

A1—6 to 18 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular, and very fine subangular blocky structure; hard, firm; calcium carbonate equivalent of 42 percent; calcareous, moderately alkaline; clear, smooth boundary.

B2—18 to 28 inches, brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; strong, fine, subangular blocky structure; hard, firm; common wormcasts; few soft masses of calcium carbonate; calcium carbonate equivalent of 54 percent; calcareous, moderately alkaline; clear lower boundary.

C1ca—28 to 42 inches, very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; about 8 percent, by volume, soft masses of calcium carbonate; calcium carbonate equivalent of 76 percent; calcareous, moderately alkaline; clear, smooth boundary.

C2—42 to 45 inches, white platy chalk and very pale brown silty clay loam from C1ca horizon in a few fine crevices; chalk hardness less than 3 on Mohs scale.

The solum ranges from 20 to 32 inches thickness. Clay content between depths of 10 and 32 inches ranges from 35 to 50 percent. Content of silicate clay ranges from 25 to 35 percent. Calcium carbonate equivalent ranges from 40 to 65 percent.

The A horizon ranges from 10 to 20 inches in thickness. It is very dark grayish brown, dark grayish grown, or brown. A few chalk fragments are on the surface and within the A horizon in places.

The B horizon ranges from 10 to 20 inches in thickness. It is brown, grayish-brown, light-brownish gray, or pale-brown silty clay to clay.

The Cca horizon is light-gray or very pale brown silty clay loam to silty clay. Few to common soft masses of calcium carbonate and fragments of chalk are in most places. A C horizon of white platy chalk or soft limestone or marl interbedded with chalk is at a depth of 24 to 40 inches.

AuB—Austin silty clay, 1 to 3 percent slopes. This gently sloping soil is on broad, irregularly shaped, slightly convex ridges. Areas range from about 50 to 200 acres in size. Slopes have a gradient that averages about 2 percent. This soil has the profile described as representative of the series (fig. 8).

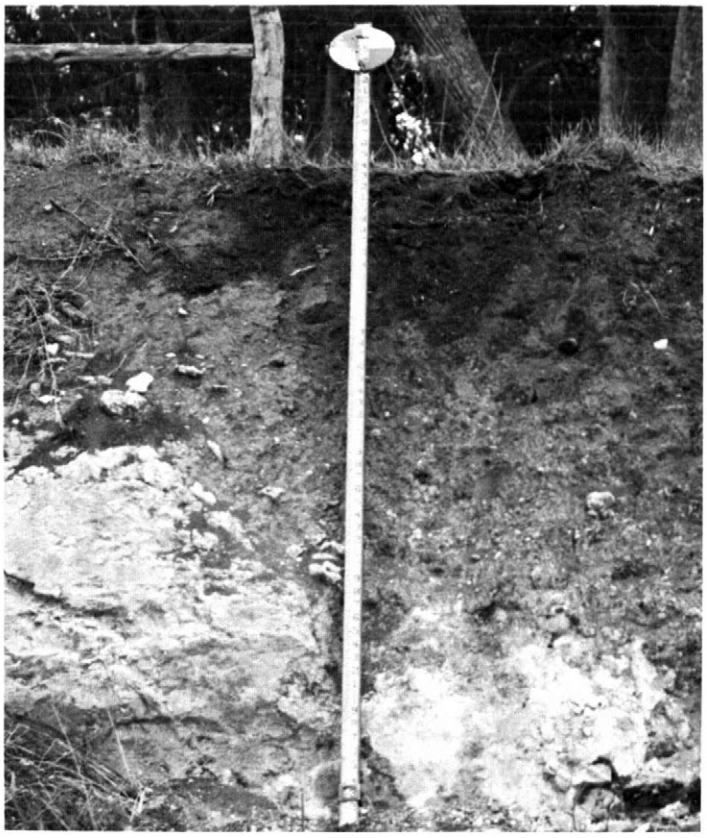


Figure 8.—**Profile of Austin silty clay, 1 to 3 percent slopes, showing the underlying chalk at depths of about 24 to 40 inches.**

Included with this soil in mapping are spots of Doss soils in a slightly higher position than this Austin soil, Altoga soils in the same position, and Houston Black soils in nearly level parts of ridges. These spots are less than 5 acres in size.

Runoff is medium. The hazard of water erosion is moderate. The soil is used mainly for growing crops and for improved pasture grasses, and it is suited to these uses. A few areas are in native range. Suburban development is expanding onto a few areas. Capability unit IIIe–2; Clay Loam range site.

AuC3—Austin silty clay, 3 to 5 percent slopes, eroded. This gently sloping soil is in long, narrow areas that are mainly less than 50 acres in size. Slopes are single and have a gradient that averages about 4 percent. Water erosion has removed the surface layer in about 25 to 50 percent of most mapped areas. Gullies make up about 5 to 15 percent of the mapped areas and are 1 to 3 feet deep, 4 to 8 feet wide, and 300 to 600 feet apart.

The surface layer is dark grayish-brown silty clay about 12 inches thick. The next layer is grayish-brown silty clay about 10 inches thick. The next lower layer is light brownish-gray silty clay that has common soft masses of lime and is about 8 inches thick. This layer grades into white platy chalk at a depth of about 30 inches.

Included with this soil in mapping are a few spots of Heiden and Altoga soils in about the same position as Austin soils and a few spots of Doss soils on ridgetops. These spots are less than 5 acres in size.

Runoff is medium. The hazard of water erosion is moderate. Some areas of the soil are abandoned, eroded cropland. A few areas are used for growing grazing crops. The soil is suited to improved pasture grasses if gullies are shaped, smoothed, and filled. Suburban development has expanded to some areas. Capability unit IVe–1; Clay Loam range site.

Barbarosa Series

The Barbarosa series consists of deep, noncalcareous, nearly level to gently sloping, clayey soils on ancient stream terraces. These soils formed in ancient, calcareous, clayey alluvium.

In a representative profile the surface layer is very dark grayish-brown silty clay about 24 inches thick. The next layer, to a depth of 72 inches, is clay. It is reddish brown in the upper part and reddish yellow in the lower part.

Barbarosa soils are well drained. Runoff is slow to medium, internal drainage is medium, and permeability is slow. Available water capacity is high. The hazard of water erosion is slight to moderate.

Representative profile of Barbarosa silty clay, 0 to 1 percent slopes, 2 miles northwest of Seguin on Texas Highway 25, 1 mile east on gravel road, then 300 feet into field south of road:

Ap—0 to 6 inches, very dark grayish-brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate, medium, granular, and very fine, subangular blocky structure; hard, friable; few cracks 0.5 inch wide and 14 inches long; few fine roots; mildly alkaline; clear, smooth boundary.

A1—6 to 24 inches, very dark grayish-brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; moderate, very fine, subangular blocky structure; hard, firm; few cracks 0.5 inch wide and 12 inches long; few fine roots; few reddish-brown wormcasts; few shiny pressure faces on peds in lower part; mildly alkaline; clear, smooth boundary.

B2t—24 to 48 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate, fine angular blocky structure; hard, firm; few streaks of very dark grayish-brown silty clay in filled cracks; few reddish-yellow wormcasts; thin clay films and pressure faces on peds; few fine calcium-carbonate concretions in lower part; calcareous, moderately alkaline; clear, smooth boundary.

B3tca—48 to 72 inches, reddish-yellow (5YR 6/6) clay, yellowish red (5YR 5/6) moist; weak, fine, angular blocky structure; hard, firm; few thin clay films and pressure faces on peds; about 15 percent, by volume, fine and medium calcium-carbonate concretions and soft masses of calcium carbonate; few limestone pebbles.

The solum ranges from 60 to 72 inches or more in thickness. Depth to visible, secondary calcium carbonate is 28 to 40 inches.

The A horizon is 14 to 28 inches thick. It is dark brown, dark grayish brown, or very dark grayish brown. It is mildly alkaline or moderately alkaline.

The B2t horizon is silty clay or clay, and clay content ranges from 40 to 60 percent. It is reddish brown, dark reddish brown, or brown. The B3tca horizon is yellowish-red or reddish-yellow clay or silty clay. It is 5 to 30 percent, by volume, fine and medium concretions and soft masses of calcium carbonate. A few limestone and siliceous pebbles are in all horizons in places. Thick beds of limestone gravel and sand are below a depth of 72 inches in places.

BaA—Barbarosa silty clay, 0 to 1 percent slopes.

This nearly level soil is on terraces. Areas are mainly 100 to 200 acres in size, but they range from 10 to 400 acres in size. They have a somewhat irregular, oval shape. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Branyon, Lewisville, and Queeny soils. Branyon soils are in slight depressions, Lewisville soils are on low ridges, and Queeny soils are in thin areas. These included spots are mainly less than 2 acres in size.

Runoff is slow. The hazard of water erosion is slight. The soil is mainly used for cultivated crops. It is suited to irrigation if water is available. Capability unit IIs–1; Clay Loam range site.

BaB—Barbarosa silty clay, 1 to 3 percent slopes. This gently sloping soil is on terraces. Areas are mainly long and narrow, and soils in the areas slope to small drainageways. A few areas are on oval-shaped knolls. Areas range from about 10 to 50 acres in size. Slopes are mainly single in the long and narrow areas and convex on the knolls. They have a gradient that averages about 2 percent.

The surface layer is dark grayish-brown silty clay about 16 inches thick. The next layer is about 56 inches thick. It is brown, firm clay in the upper part and light yellowish-brown, firm silty clay in the lower part. The lower part is about 10 percent, by volume, concretions and soft masses of lime.

Runoff is medium. The hazard of water erosion is moderate. The soil is used mainly for crops. Capability unit IIe–2; Clay Loam range site.

Bosque Series

The Bosque series consists of deep, nearly level, calcareous, loamy soils on bottom lands. These soils formed in stratified, loamy alluvial sediment.

In a representative profile the surface layer is dark grayish-brown loam about 24 inches thick. The next layer, about 14 inches thick, is brown, friable loam. It is underlain, to a depth of 60 inches, by pale-brown, very friable silty clay loam that contains a few, thin, sandy strata.

In a representative profile the surface layer is dark grayish-brown loam about 24 inches thick. The next layer, about 14 inches thick, is brown, friable loam. It is underlain, to a depth of 60 inches, by pale-brown, very friable silty clay loam that contains a few, thin, sandy strata.

Bosque soils are well drained. Runoff is slow, internal drainage is medium, and permeability is moderate. Available water capacity is high. The soils are subject to overflow at least once a year.

Representative profile of Bosque loam in an area of Bosque and Seguin soils, frequently flooded, in the flood plain of the San Marcos River, about 300 feet north of Farm Road 1977 near Staples:

A1—0 to 24 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular, and very fine, subangular blocky structure; hard, friable; common fine roots; few fine pores; common wormcasts; few thin clayey strata in lower part; calcareous, moderately alkaline; gradual, smooth boundary.

B2—24 to 38 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak, very fine, subangular blocky structure; hard, friable; few fine roots; few fine pores; few wormcasts; few films and threads of calcium carbonate; few thin clayey strata; calcareous, moderately alkaline; gradual, smooth boundary.

C—38 to 60 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; slightly hard; very friable; few fine roots in upper part; few films and threads of calcium carbonate; few thin sandy and loamy strata; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches in thickness. Texture between depths of 10 and 40 inches is loam, silty clay loam, or clay loam. The solum is 20 to 35 percent clay.

The A horizon is 14 to 30 inches thick. It is dark grayish brown, dark brown, grayish brown, or brown. The B2 horizon is grayish brown, brown, or pale bown. The C horizon is light bownish-gray, pale-brown, or very pale brown loam to silty clay.

Bo—Bosque and Seguin soils, frequently flooded. These nearly level soils are on the lowest part of flood plains. They are subject to flooding for less than 2 days at least one time in spring or in fall each year. Areas are long, narrow, and winding and follow the drainage patterns of rivers and creeks. Landscape of the areas is undulating because of the deposition and scouring of overflows, and within the areas are small ridges with low areas between them. The low areas are old channels.

The soils are quite variable in color and texture because of continuous deposition and scouring. The Bosque soil has the profile described as representative of the Bosque series. The surface layer of the Seguin soil is brown silty clay loam about 15 inches thick. The next layer is grayish-brown silty clay loam about 20 inches thick. The next lower layer is pale-brown silty clay loam about 20 inches thick. The underlying material, to a depth of 65 inches, is light brownish-gray silty clay loam.

Composition of this mapping unit is variable, and the soils occur without regularity. The Bosque soil makes up as much as 75 percent of the mapped areas, but it ranges from 25 to 75 percent. The Seguin soil makes up as much as 75 percent of mapped areas, but it averages about 25 percent. Both soils are on small ridges and in low areas of old channels. Included in some mapped areas are a few spots of Trinity soils in low areas of old channels.

These soils are not suited to crops or as building sites because of the frequent overflow. They are well suited to pecans, improved pastures, and recreation. Large pecan and cypress trees provide food and protection for wildlife. They also provide shade for cattle, camping, and picnic areas. Capability unit Vw–1; Loamy Bottomland range site.

Branyon Series

The Branyon series consists of deep, calcareous, nearly level to gently sloping, clayey soils on ancient stream terraces. These soils formed in ancient clayey alluvium.

In a representative profile in the center of a microdepression, the surface layer is very dark gray clay about 52 inches thick. The next layer, about 12 inches thick, is gray, very firm clay in the upper part and pale-brown, extremely firm clay in the lower part. It is underlain by very pale brown, friable silty clay loam that is about 10 percent, by volume, limestone pebbles and concretions and soft masses of lime.

Branyon soils are moderately well drained. Runoff is slow to medium, internal drainage is slow, and permeability is very slow. When the soils are dry, water enters cracks rapidly until they close. Available water capacity is high. The hazard of water erosion is slight to moderate.

Representative profile of Branyon clay, 0 to 1 percent slopes, at the center of a microdepression 6 miles north of Seguin on Texas Highway 123 to Geronimo, 2.5 miles west on paved road to Friedens Church, 0.25 mile south on paved road, then 400 feet into field west of road:

A11—0 to 24 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; surface mulch of fine, discrete, hard aggregates about 0.5 inch thick; moderate, fine and medium, angular and subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; shiny pressure faces on peds; few limestone and siliceous pebbles; few fine iron-manganese concretions; calcareous, moderately alkaline; gradual, wavy boundary.

A12—24 to 52 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, fine and medium, angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; common intersecting slickensides; few parallelepipeds tilted more than 10 degrees from horizontal; few fine iron-manganese concretions; calcareous, moderately alkaline; gradual, wavy boundary.

AC1—52 to 58 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, medium, angular blocky structure; very hard, very firm, very sticky and very plastic; common intersecting slickensides; few parallelepipeds tilted more than 10 degrees from horizontal; few streaks of grayish brown in old worm channels and dark gray in old cracks; few fine calcium-carbonate concretions; few fine iron-manganese concretions; few limestone pebbles; calcareous, moderately alkaline; gradual, wavy boundary.

AC2—58 to 64 inches, pale-brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak, medium, blocky structure; extremely hard, extremely firm, very sticky and very plastic; common intersecting slickensides; few parallelepipeds tilted more than 10 degrees from horizontal; common medium streaks of dark gray from AC1 horizon in old cracks; common fine calcium-carbonate concretions and few, medium, soft masses of calcium carbonate; few fine iron-manganese concretions; few limestone pebbles; calcareous, moderately alkaline; gradual, smooth boundary.

IICca—64 to 76 inches, very pale brown (10YR 7/4) silty clay loam, light yellowish brown (10YR 6/4) moist; few, fine, faint, yellow mottles; massive; hard, friable; few fine streaks of grayish brown from above horizons in old cracks; about 10 percent, by volume, fine calcium-carbonate concretions and medium soft masses of calcium carbonate; few limestone pebbles; few fine iron-managanese concretions; calcareous, moderaly alkaline.

The A and AC horizons combined range from 60 to 80 inches in thickness. Within a horizontal distance of 8 to 10 feet, the A horizon ranges from 18 to 55 inches in thickness in the center of the microknoll to 36 to 60 inches in the center of the microdepression. Chromas are less than 1.5 to these depths. The amplitude of thickness of horizons varies more than 12 inches from the microknoll to the microdepression. In native areas the microknolls are about 10 to 18 inches higher than the microdepressions. Clay makes up 50 to 60 percent of the soil material between depths of 10 and 40 inches.

The A1 horizon is very dark gray, dark gray, or gray. The AC horizon is gray, grayish brown, or pale brown. Streaks and mottles in shades of gray, brown, and yellow are present in most places. The AC horizon is mainly clay but ranges to silty clay. It contains few to common, fine, calcium-carbonate concretions, soft masses of calcium carbonate, and a few, fine, black or brown, iron-manganese concretions.

The IICca horizon is silty clay loam, loam, or clay loam. It is 5 to 10 percent, by volume, fine calcium-carbonate concretions and medium soft lumps of calcium carbonate. In some profiles limestone pebbles make up 50 percent, by volume, of the soil material, and the material is stratified with sand below a depth of about 10 feet.

BrA—Branyon clay, 0 to 1 percent slopes. This nearly level soil is mainly on old, high terraces. Many of the soil areas are as much as 1,000 acres or more in size. Some areas on low terraces range from 20 to 100 acres in size (fig. 9). This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Burleson, Lewisville, and Barbarosa soils. Burleson soils are in about the same position as Branyon soils, but their surface is crusty. The Lewisville and Barbarosa soils are on low ridges. These included spots make up less than 15 percent of the mapped areas.

Runoff is slow. The hazard of water erosion is slight. The soil is used mainly for crops. It is suited to irrigation if water is available. Capability unit IIw–1; Blackland range site.

BrB—Branyon clay, 1 to 3 percent slopes. This gently sloping soil is in areas where stream terraces break to the uplands and in areas where terraces slope to the bottom lands. Areas are irregular in shape, and they range from about 10 to 200 acres in size. Slopes are single and have a gradient that averages about 2 percent.

The surface layer is very dark gray clay about 32 inches thick. The next layer is grayish-brown, very firm clay that has a few dark-gray streaks and is about 28 inches thick. The underlying material, below a depth of 60 inches, is very pale brown, friable silty clay loam that is about 10 percent, by volume, lumps and concretions of lime. In places this material grades to beds of water-bearing sand and gravel below a depth of 10 feet.

Included with this soil in mapping are spots of Burleson, Lewisville, and Barbarosa soils. Burleson soils have a crusty surface, and Lewisville and Barbarosa soils are less clayey than Branyon soils. Included soils make up less than 10 percent of the mapped area.

Runoff is medium. The hazard of water erosion is moderate. The soil is used mainly for cultivated crops. Capability unit IIe–1; Blackland range site.

Burleson Series

The Burleson series consists of deep, noncalcareous, nearly level to gently sloping, clayey soils on uplands and stream terraces. These soils formed in clayey sediment.

In a representative profile in a microdepression the surface layer is 30 inches thick. It is very dark gray clay in the upper 16 inches and dark-gray, very firm clay in the lower 14 inches. Below this is a transitional zone of gray, very firm clay 12 inches thick. Siliceous pebbles are about 40 percent, by volume, of the material in the upper 6 inches of the surface layer and are on the soil surface. The transitional zone has a few grayish-brown mottles and has very dark gray streaks in old cracks. The underlying material, to a depth of 60 inches, is light olive-gray, very firm clay.

Burleson soils are moderately well drained. Runoff

Figure 9.—Native pasture in an area of Branyon clay, 0 to 1 percent slopes, showing gilgai microrelief (alternating depressions and knolls). The depressions are sometimes called "hog wallows" or "buffalo wallows."

is slow to medium, internal drainage is slow, and permeability is very slow. When the soils are dry, water enters cracks rapidly until they close. Available water capacity is high. The hazard of water erosion is slight to moderate.

Representative profile of Burleson gravelly clay, 1 to 3 percent slopes, in a microdepression 9 miles north of Seguin on Texas Highway 123, 8 miles northeast on Farm Road 1339, 1.5 miles northwest on gravel road, then 0.5 mile into field east of road:

Ap—0 to 6 inches, very dark gray (10YR 3/1) gravelly clay, black (10YR 2/1) moist; weak, fine, angular blocky structure; extremely hard; very firm, very sticky and very plastic; few fine roots; thin gray surface crust about ⅛ inch thick; about 40 percent, by volume, siliceous pebbles on surface and in horizon; neutral; clear, smooth boundary.

A11—6 to 16 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few shiny pressure faces on peds in lower part; few siliceous pebbles; few iron-manganese concretions; mildly alkaline; diffuse, wavy boundary.

A12—16 to 30 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; intersecting slickensides on parallelepipeds tilted more than 30 degrees from horizontal below a depth of 20 inches; few siliceous pebbles; few, fine, iron-manganese concretions; mildly alkaline; diffuse, wavy boundary.

AC—30 to 42 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few, fine, faint, grayish-brown mottles; weak, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; intersecting slickensides on parallelepipeds tilted more than 30 degrees from horizontal; streaks of very dark gray clay in old cracks; few siliceous pebbles; few iron-manganese concretions; mildly alkaline; diffuse, wavy boundary.

C—42 to 60 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; massive; extremely hard, very firm, very sticky and very plastic; few siliceous pebbles; few, fine, calcium-carbonate concretions; few, fine, iron-manganese concretions; calcareous, moderately alkaline.

The solum ranges from 36 inches in thickness on the microknolls to more than 72 inches in the microdepressions. The A horizon ranges from 12 inches thick on microknolls to 30 inches in microdepressions. It is dark gray or very dark gray. The thin surface crust is gray or light gray. The A horizon, to a depth of 12 inches, is 0 to 50 percent siliceous pebbles. Siliceous pebbles cover 25 to 100 percent of the surface in places. Reaction in the A horizon ranges from neutral to mildly alkaline.

The AC horizon ranges from 12 to 28 inches in thickness. It is gray or dark gray. Streaks and mottles in shades of gray, brown, yellow, and olive are in most profiles. A few

calcium-carbonate concretions, iron-manganese concretions, and siliceous pebbles are in places. The AC horizon is mildly or moderately alkaline.

The C horizon ranges from gray to light olive gray. Mottles in shades of olive, brown, and yellow are present in places. Calcium-carbonate concretions, iron-manganese concretions, and limestone pebbles are present in many places.

BuA—Burleson clay, 0 to 1 percent slopes. This nearly level soil is on low, ancient stream terraces. Areas are oval and range from about 10 to 50 acres in size.

The surface layer is very dark gray clay, has a thin gray surface crust, and is about 30 inches thick. The next layer is gray, very firm clay about 18 inches thick. It is underlain below a depth of 48 inches by grayish-brown, very firm clay.

Included with this soil in mapping are a few spots of Mabank soils in a slightly higher position than this Burleson soil. These sopts are less than 3 acres in size.

Runoff is slow. The hazard of water erosion is slight. The soil is used mainly for cultivated crops. It is sometimes wet for short periods following heavy rain. Surface crusting delays emergence of seedlings. Capability unit IIw–1; Blackland range site.

ByA—Burleson gravelly clay, 0 to 1 percent slopes. This nearly level soil is mainly on ancient stream terraces. Areas have an irregular, oval shape and range from about 10 to 150 acres in size. They mainly are surrounded by areas of Branyon soils.

The surface layer is very dark gray clay, has a thin light-gray surface crust when dry, and is about 26 inches thick. About 60 percent of the surface is covered with chert pebbles, and the upper 12 inches of the surface layer is about 25 percent, by volume, pebbles. The next layer is dark-gray, very firm clay, has light olive-brown mottles, and is about 22 inches thick. It is underlain, below a depth of 48 inches, by gray, very firm clay that has a few yellowish-brown mottles.

Included with this soil in mapping are a few spots of Branyon soils in about the same position as this Burleson soil. These spots are less than 3 acres in size.

Runoff is slow. The hazard of water erosion is slight. The soil is used for crops. The hard surface crust sometimes delays emergence of seedlings. The gravel on the surface acts as a mulch and reduces water evaporation. Capability unit IIw–1; Blackland range site.

ByB—Burleson gravelly clay, 1 to 3 percent slopes. This gently sloping soil is on uplands and ancient stream terraces. Some areas are long and narrow, and others have an irregular, oval shape. Areas are mainly less than 50 acres in size. Slopes have a gradient that averages about 2 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are a few spots of Houston Black gravelly soils and Branyon soils. These soils are in about the same positions as Burleson gravelly soils, but they do not have a crusty surface. These spots are less than 3 acres in size.

Runoff is medium. The hazard of water erosion is moderate. The soil is used mainly for crops, but in a few areas it is used for improved pasture. The soil is suited to these uses. The hard surface crust sometimes delays emergence of seedlings. The gravel on the surface acts as a mulch and reduces water evaporation. Capability unit IIe–1; Blackland range site.

Crockett Series

The Crockett series consists of deep, noncalcareous, nearly level to sloping, loamy soils on uplands.

In a representative profile the surface layer is brown fine sandy loam about 8 inches thick. The upper 38 inches of the subsoil is clay. It is mottled brownish yellow, light olive brown, and red in the upper 6 inches; olive yellow mottled with red and brownish yellow in the next 20 inches; and reddish yellow mottled with yellowish brown in the lower 12 inches. The lower 16 inches of the subsoil is yellow sandy clay. The underlying material, to a depth of 72 inches, is brownish-yellow sandy loam and light brownish-gray clay.

Crockett soils are moderately well drained. Runoff is slow to rapid, internal drainage is slow, and permeability is very slow. Available water capacity is high. The hazard of water erosion is slight to severe.

Representative profile of Crockett fine sandy loam, 1 to 3 percent slopes, about 17 miles east of Seguin on U.S. 90, 1.2 miles northwest on paved county road, 0.5 mile northeast on gravel road to a cemetery, then 300 feet into field southwest of cemetery:

Ap—0 to 8 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; very hard, friable; few fine roots; few wormcasts; slightly acid; abrupt, wavy boundary.

B21t—8 to 14 inches, prominently and coarsely mottled brownish-yellow (10YR 6/6), light olive-brown (2.5Y 5/4) and red (2.5YR 5/8) clay; moderate, fine and medium, blocky structure; extremely hard, very firm; few fine roots; few fine pores; thick clay films on faces of peds and in pores; cracks more than 0.5 inch wide filled with brown fine sandy loam; few, fine, iron-manganese concretions; slightly acid; clear, wavy boundary.

B22t—14 to 34 inches, olive-yellow (2.5Y 6/6) clay, light olive brown (2.5Y 5/6) moist; few, fine, prominent, red mottles and few, fine, distinct, brownish-yellow mottles; moderate, medium, blocky structure; extremely hard, very firm; few fine pores; thick clay films on faces of peds and in pores; cracks more than 0.5 inch wide filled with brown fine sandy loam; few, fine, iron-manganese concretions; slightly acid; gradual, wavy boundary.

B23t—34 to 46 inches, reddish-yellow (7.5YR 6/6) clay, strong brown (7.5YR 5/6) moist; common, fine, distinct, yellowish-brown mottles; weak, medium, blocky structure; extremely hard, very firm; few fine pores; thick clay films on faces of peds and in pores; few, fine, iron-manganese concretions; neutral; gradual, wavy boundary.

B3—46 to 62 inches, yellow (10YR 7/6) sandy clay, brownish yellow (10YR 6/6) moist; common, medium, faint, yellowish-brown mottles and few, fine, faint, pale-brown mottles; weak, medium, blocky structure; extremely hard, very firm; few fine pores; few clay films on faces of peds and in pores; thin, interbedded, sandy layers in lower part; common, fine, iron-manganese concretions; mildly alkaline; gradual, wavy boundary.

C—62 to 72 inches, interbedded brownish-yellow (10YR 6/8) sandy loam and light brownish-gray (10YR 6/2) clay in about equal amounts; massive; extremely hard, friable; common fine pores; calcareous, moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. The A horizon ranges from 4 to 15 inches in thickness but is less than 10 inches thick in more than 50 percent of the profiles.

The A horizon is dark grayish-brown, grayish-brown, dark-brown, or brown fine sandy loam, loam, or gravelly sandy loam. Siliceous pebbles are as much as 50 percent, by volume, of the A horizon in places. Reaction ranges from slightly acid to neutral.

The B21t horizon ranges widely in color within short distances. In places it has a mottled matrix in any combination of red, gray, brown, olive, or yellow. In other places it has a matrix color of reddish brown or dark reddish brown and is mottled in any combination of red, gray, brown, olive, or yellow. The lower part of the B2t horizon and the B3 horizon are mainly shades of brown, gray, yellow, and olive. The B horizon ranges from clay loam to clay, and the content of clay ranges from 35 to 50 percent. The upper 20 inches of the Bt horizon contains as much as 15 percent, by volume, siliceous pebbles. Reaction in the B horizon ranges from medium acid to slightly acid in the upper part and from slightly acid to mildly alkaline in the lower part.

The C horizon is mainly interbedded sand, clay, or shale. It ranges from clay or shaly clay interbedded with sandy material to sandy loam interbedded with clayey and shaly material. The C horizon is mainly shades of yellow, olive, gray, or brown. Reaction ranges from mildly alkaline to moderately alkaline.

CfA—Crockett fine sandy loam, 0 to 1 percent slopes. This nearly level soil is in scattered areas. Some areas are oval, and others are long and narrow. They range from about 10 to 50 acres in size. Slopes are single and have a gradient that averages about 0.5 percent.

The surface layer is brown fine sandy loam about 10 inches thick. The next layer is about 54 inches thick. The upper part is mottled red, yellowish-brown and brown, very firm clay; the middle part is yellowish-brown, very firm clay that has brownish-yellow and yellowish-red mottles; and the lower part is reddish-yellow, very firm sandy clay that has a few yellowish-red mottles. This layer is underlain below a depth of 64 inches by brownish sandy loam that has thin, interbedded layers of brownish-gray shale.

Included with this soil in mapping are a few spots of Mabank soils in low areas and Demona soils on small ridges. These spots are less than 3 acres in size and make up less than 15 percent of the mapped areas.

Runoff is slow. The hazard of water erosion is slight. The soil is used mainly for growing grazing crops and for improved pasture grasses. It is better suited to improved pasture grasses than to most other uses. Capability unit IIIs–1; Claypan Prairie range site.

CfB—Crockett fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is in areas that range from about 10 to 200 acres in size. Areas are mainly long and irregular in shape. Slopes are slightly convex and have a gradient that averages about 2 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Mabank soils in low areas and Demona and Windthorst soils on small ridges. These spots are less than 3 acres in size and make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. The soil is mostly abandoned cropland, and brush encroachment is a concern. The soil is suited to improved pasture grasses when brush is controlled. A few areas are used for growing grazing crops. Capability unit IIIe–3; Claypan Prairie range site.

CgC—Crockett gravelly sandy loam, 1 to 5 percent slopes. This soil is mainly in the eastern and southern parts of the county. Smaller areas mostly have an irregular, oval shape, and larger areas have an irregular, long shape. Areas range from 10 to 150 acres in size. Slopes are single and convex and have a gradient that averages about 3 percent.

The surface layer is dark-brown gravelly sandy loam about 10 inches thick. It is about 40 to 50 percent chert pebbles. The next layer is strong-brown, very firm sandy clay about 13 inches thick. The next lower layer is light brownish-gray, very firm sandy clay about 13 inches thick. The underlying material, below a depth of 44 inches, is light-gray, very firm shaly clay interbedded with brownish-yellow sand.

Included with this soil in mapping are spots of Vernia, Mabank, and Windthorst soils. Vernia and Windthorst soils are on low ridges, and Mabank soils are in low areas. These spots make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. The soil is mostly abandoned cropland. A few areas are in native range. Brush encroachment is a concern. The soil is better suited to improved pasture grasses when brush is controlled than to other uses. The gravelly surface layer and the very slow permeability of the dense, clayey lower layers cause the soil to be droughty. Capability unit IVe–2; Claypan Prairie range site.

CsC3—Crockett loam, 2 to 5 percent slopes, eroded. This soil is in scattered areas. Areas are mainly irregular in shape, and they range from about 10 to 200 acres in size. Slopes are single and convex. Water erosion has removed part of the surface layer from about 20 to 40 percent of most mapped areas. Gullies, about 1 to 6 feet deep and 6 to 20 feet wide, make up about 25 to 30 percent of most areas. They are mainly 200 to 500 feet apart.

The surface layer is brown loam about 4 inches thick. The next layer, to a depth of about 60 inches, is reddish-brown, very firm clay in the upper part; light olive-brown, very firm clay in the middle part; and light brownish-gray, very firm sandy clay in the lower part. It has red, light olive-brown, and yellowish-brown mottles. Interbedded sand and clay is below a depth of 60 inches.

Included with this soil in mapping are spots of Windthorst soils on ridges, Demona soils in concave positions below Crockett soils, and Mabank soils on low slopes.

These spots are less than 3 acres in size, and they make up less than 15 percent of the mapped areas. Also included are some areas of eroded Crockett soil with a surface layer of clay loam.

Runoff is medium. The hazard of water erosion is severe. The soil is mostly abandoned, eroded cropland. Brush encroachment is a concern. A few areas are used for growing grazing crops. The soil is better suited to improved pasture grasses than to other uses if gullies are shaped, smoothed, and filled and brush is controlled. Capability unit IVe–2; Claypan Prairie range site.

CsD4—Crockett loam, 3 to 8 percent slopes, severely eroded. This soil is in areas that range from about 10 to 150 acres in size. Some areas are long and narrow, and others have an irregular, oval shape. Slopes are convex and single. Water erosion has removed the surface layer in 80 to 100 percent of the mapped areas and has also removed part of the lower layers in about

20 to 25 percent of the mapped areas. Gullies, 3 to 20 feet deep and 5 to 100 feet wide, make up about 40 to 50 percent of the mapped areas. They are about 30 to 150 feet apart.

The surface layer is grayish-brown loam about 4 inches thick. The next layer, to a depth of 60 inches, is clay. It is olive yellow in the upper part and reddish yellow in the lower part. The underlying material is interbedded sandy loam and clay.

Included with this soil in mapping are spots of severely eroded Windthorst soils in about the same position as this Crockett soil. These spots make up less than 15 percent of the mapped areas.

Runoff is rapid. The hazard of water erosion is severe. The soil is mostly abandoned, eroded cropland. Brush infestation is a concern. This soil is not suited to cultivated crops because of erosion. Some areas are suitable for improved pasture grasses when gullies are shaped, smoothed, and filled and brush is controlled. Capability unit VIe–1; Claypan Prairie range site.

Darst Series

The Darst series consists of moderately deep, noncalcareous, sloping to strongly sloping, very gravelly loamy soils on uplands. These soils formed in massive siltstone or mudstone.

In a representative profile the surface layer is very gravelly sandy loam about 8 inches thick. It is brown in the upper part and yellowish brown in the lower part. It is about 65 percent, by volume, siliceous pebbles. The subsoil is about 29 inches thick. It is red clay in the upper part and red sandy clay in the lower part. It is underlain by reddish-yellow mudstone to a depth of 50 inches.

Darst soils are well drained. Runoff is rapid, internal drainage is medium, and permeability is moderately slow. Available water capacity is medium. The hazard of water erosion is severe.

Representative profile of Darst very gravelly sandy loam, 5 to 10 percent slopes, 9 miles east of Seguin on U.S. Highway 90 to Kingsbury, 6 miles south on Farm Road 1104, 0.8 mile southeast on gravel road, then 100 feet into range west of road:

A1—0 to 5 inches, brown (10YR 5/3) very gravelly sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; hard, friable; common fine roots; about 65 percent, by volume, siliceous pebbles 0.25 to 3 inches in diameter; few 3- to 5-inch cobbles on surface; medium acid; clear, smooth boundary.

A2—5 to 8 inches, yellowish-brown (10YR 5/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; weak, fine, granular structure; hard, friable; few fine roots; pebble content same as A1 horizon; medium acid; abrupt, smooth boundary.

B21t—8 to 22 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, fine and medium, blocky structure; very hard, firm; few fine roots; few fine pores; thick clay films on ped faces and in pores; very strongly acid; gradual, smooth boundary.

B22t—22 to 30 inches, red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; few, fine, prominent, brownish-yellow mottles; moderate, fine, blocky structure; very hard, firm; few fine roots; few fine pores; thick clay films on ped faces and in pores; very strongly acid; gradual, smooth boundary.

B3—30 to 37 inches, red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; few, fine, prominent, brownish-yellow and pale-brown mottles; weak, fine, blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on ped faces and in pores; very strongly acid; clear, smooth boundary.

C—37 to 50 inches, reddish-yellow (7.5YR 6/6) mudstone, strong brown (7.5YR 5/6) moist; massive; extremely hard, very firm; thin, discontinuous, interbedded layers of strongly cemented sandstone; very strongly acid.

The solum to massive pack sand interbedded with fine sandstone, mudstone, and siltstone ranges from 20 to 40 inches in thickness. The A horizon is 4 to 12 inches thick. The A1 horizon is dark brown, brown, yellowish brown, or dark yellowish brown. In the A2 horizon value and chroma are generally 1 or 2 units higher than they are in the A1 horizon. Siliceous pebbles and sandstone fragments, mainly less than 3 inches in diameter, make up 70 percent, by volume. The A horizon is slightly acid or medium acid. A few sandstone and siliceous cobbles are on the surface in places.

The Bt horizon is red, yellowish red, reddish brown, or light reddish brown. Mottles in shades of gray, brown, or yellow are in the lower part of the Bt horizon in places. The Bt horizon is medium acid to very strongly acid. The B2t horizon is clay or sandy clay, and clay makes up 35 to 55 percent of this horizon. The B3 horizon is sandy clay or sandy clay loam. The C horizon is reddish, brownish, or yellowish, acid, massive packsand and has thin, discontinuous, interbedded layers of sandstone, mudstone, and siltstone.

DgE—Darst very gravelly sandy loam, 5 to 10 percent slopes. This sloping to strongly sloping soil is mainly above small drainageways. Areas are long and narrow, and they range from about 20 to 300 acres in size. Slopes are single and have a gradient that averages about 8 percent (fig. 10).

Included with this soil in mapping are spots of Vernia and Crockett soils on ridgetops. These spots make up less than 15 percent of the mapped areas.

Runoff is rapid. The hazard of water erosion is severe. The large amounts of gravel in the surface layer help control erosion. The soil is used mainly for native range, and it is better suited to this use than to most others. It is not suited to crops. Slope and the high content of gravel in the surface layer make it difficult to establish improved pasture grasses. Capability unit VIe–2; Sandy Loam range site.

Demona Series

The Demona series consists of deep, noncalcareous, gently sloping, sandy soils on uplands. These soils formed in interbedded sandy to loamy material.

In a representative profile the surface layer is about 24 inches thick. It is pale-brown loamy fine sand in the upper part and very pale brown loamy fine sand in the lower part. The next 12 inches is brownish-yellow, very firm clay that has a few red and light-gray mottles. The 10 inches below it is mottled, red, brownish-yellow, and light-gray, very firm clay. The 14 inches below that is red, firm sandy clay that has light brownish-gray and brownish-yellow mottles.

Demona soils are moderately well drained. Runoff is slow to medium, internal drainage is slow, and permeability is moderately slow. Available water capacity is medium. The hazards of soil blowing and water erosion are moderate.

Representative profile of Demona loamy fine sand, 1 to 5 percent slopes, 9 miles south of Seguin on Texas Highway 123, 0.5 mile northwest on gravel road, then 150 feet into pasture south of road:

A1—0 to 12 inches, pale-brown (10YR 6/3) loamy fine sand,

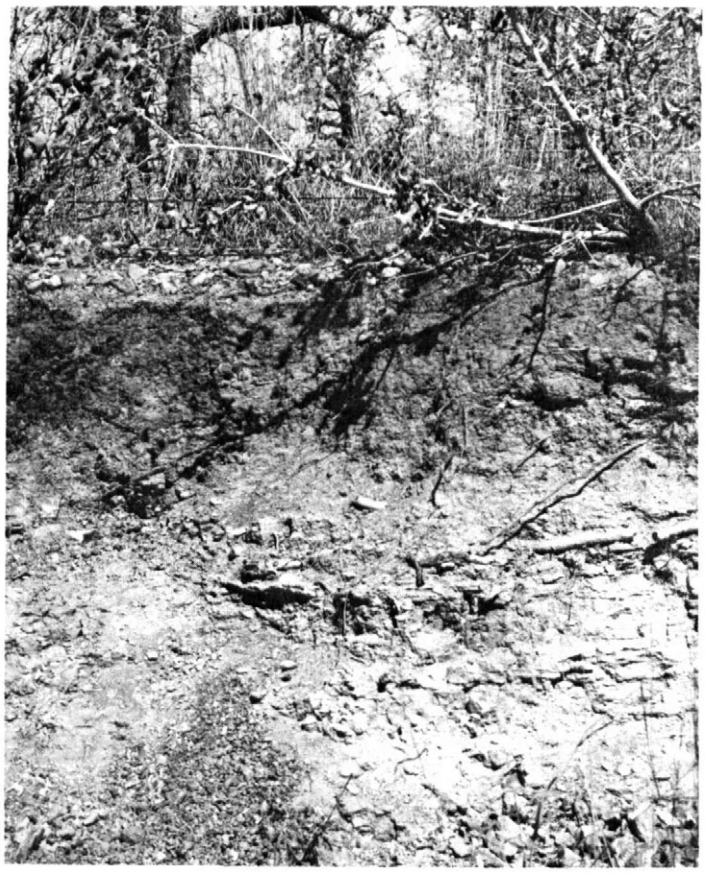


Figure 10.—**Profile of Darst very gravelly sandy loam, 5 to 10 percent slopes, showing massive packsand interbedded with sandstone and siltstone at depths of 20 to 40 inches.**

brown (10YR 5/3) moist; single grained; loose; few fine roots; neutral; clear, smooth boundary.

A2—12 to 24 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots; neutral; abrupt, wavy boundary.

B21t—24 to 36 inches, brownish-yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; few, fine, faint, light-gray mottles and few, fine, prominent, red mottles; weak, coarse, blocky structure; extremely hard, very firm; few fine roots; few fine pores; few fine iron-manganese concretions; thick clay films on ped faces; slightly acid; gradual, wavy boundary.

B22t—36 to 46 inches, prominently mottled red (2.5YR 4/6), brownish-yellow (10YR 6/6), and light-gray (10YR 7/1) clay; weak, coarse, blocky structure; extremely hard, very firm; few fine pores; few fine iron-manganese concretions; thick clay films on ped faces; slightly acid; gradual, wavy boundary.

B3—46 to 60 inches, red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; common, fine, prominent light brownish-gray mottles and few, fine, prominent, brownish-yellow mottles; weak, medium, blocky structure; very hard, firm; few fine pores; few fine iron-manganese concretions; few thin clay films on ped faces; slightly acid.

The solum ranges from 60 to 80 inches in thickness. Clay make up 35 to 50 percent of the soil material.

The A horizon ranges from 20 to 40 inches in thickness. The A1 horizon is brown, pale brown, reddish yellow, or light brown. Value in the A2 horizon is mainly 1 unit higher than it is in the A1 horizon. The A horizon is loamy fine sand or fine sand. Reaction ranges from medium acid to neutral.

The B horizon ranges from 30 to 50 inches in thickness. Matrix coloring ranges from brownish yellow or red mottled in shades of red, gray, brown, or yellow to a mottled coloring in shades of red, gray, brown, or yellow. The B2t horizon ranges from sandy clay to clay. The B3 horizon ranges from sandy clay loam to sandy clay. Reaction in the B2t horizon ranges from strongly acid to slightly acid. Reaction in the B3 horizon ranges from medium acid to mildly alkaline. The C horizon, where present, is medium acid to mildly alkaline, interbedded sand and clay in shades of red, gray, brown, or yellow.

DmC—Demona loamy fine sand, 1 to 5 percent slopes. This gently sloping soil is mainly in irregularly shaped, concave areas. Areas range from about 10 acres to as much as 300 acres in size. Slopes have a gradient that averages about 2 percent (fig. 11).

Included with this soil in mapping in most areas is a soil similar to this Demona soil, but the surface layer is only 16 to 20 inches thick. It makes up about 21 percent of the mapped areas and is in the same position as this Demona soil but does not occur in a pattern. It appears to have been formed by wind erosion that thinned the surface of Demona soils. A few spots of Patilo, Windthorst, and Crockett soils are included in some areas. Patilo and Windthorst soils are on ridges, and Crockett soils are in low areas. These spots are less than 2 acres in size.

Runoff is slow to medium. The hazards of water

Figure 11.—**Profile of Demona loamy fine sand, 1 to 5 percent slopes, showing the thick sandy surface layer over the clayey lower layer.**

erosion and soil blowing are moderate. The soil is used mainly for improved pasture and such specialty crops as peanuts and watermelons, and it is well suited to these uses. It is suited to a sprinkler irrigation system. A few areas are in native range, and brush encroachment is a concern in these areas. Capability unit IIIe–4; Sandy range site.

Doss Series

The Doss series consists of shallow, calcareous, gently sloping, clayey soils on uplands. These soils formed in residuum weathered from calcareous marl and weakly cemented limestone.

In a representative profile the surface layer is dark grayish-brown silty clay about 8 inches thick. The next layer, about 7 inches thick, is brown, firm silty clay that is about 10 percent, by volume, platy chalk fragments. The underlying material, to a depth of 20 inches, is white platy chalk that has dark grayish-brown silty clay in a few small cracks in the upper part.

Doss soils are well drained. Runoff is medium, internal drainage is medium, and permeability is moderately slow. Available water capacity is low. The hazard of water erosion is moderate.

Representative profile of Doss silty clay, 1 to 3 percent slopes, 20 miles west of Seguin on Farm Road 78 to Schertz, 2.7 miles north on Farm Road 1518, 1.2 miles east on Liveoak Hills subdivision road, then 300 feet into brushy pasture south of road:

A1—0 to 8 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong, fine, granular, and very fine, subangular blocky structure; hard, firm; common fine roots; few fine chalk fragments; calcareous, moderately alkaline; clear, smooth boundary.

Bca—8 to 15 inches, brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate, fine granular, and very fine, subangular blocky structure; hard, firm; few fine roots; about 10 percent, by volume, platy chalk fragments as much as 3 inches across the long axis; fragments have coatings of secondary calcium carbonate; calcium carbonate equivalent of 44 percent; calcareous, moderately alkaline; clear, smooth boundary.

C—15 to 20 inches, white (10YR 8/1) platy chalk; hardness of less than 3 on Mohs' scale; few crevices filled with dark grayish-brown silty clay; few fine roots in crevices; some chalk fragments have patchy secondary accumulations of calcium carbonate.

Depth to chalk or soft limestone ranges from 12 to 20 inches. The A horizon ranges from 8 to 12 inches in thickness. It is dark grayish brown or dark brown. The A and Bca horizons are silty clay or clay loam, and clay makes up 35 to 50 percent of these horizons. Silicate clay ranges from 25 to 35 percent. The Bca horizon ranges from 4 to 8 inches in thickness. Calcium carbonate makes up from 40 to 50 percent of this horizon. It is reddish brown or brown. The C horizon is white or very pale brown chalk or soft limestone with a hardness of less than 3 on the Mohs' scale.

DoB—Doss silty clay, 1 to 3 percent slopes. This gently sloping soil is mainly on narrow, irregularly shaped, convex ridges. Most areas range from 10 to 40 acres in size, but some are as much as 100 acres. Slopes are convex and have a gradient that averages about 2 percent.

Included with this soil in mapping are spots of Eddy and Austin soils. Eddy soils are in outcrop areas, and Austin soils are in low areas. These spots are less than 3 acres in size. They make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. This soil is used mainly for native range and suburban development. A few areas are used for grazing. Because chalk is at a shallow depth, the soil is not suited to crops or improved pastures. Scattered live oak trees make this soil suited to homesites. Capability unit IIIe–5; Chalky Ridge range site.

Eddy Series

The Eddy series consists of very shallow, calcareous, gently sloping, gravelly, loamy soils on uplands. These soils formed in material weathered from chalk.

In a representative profile the surface layer is grayish brown, gravelly clay loam about 4 inches thick. It is about 50 percent, by volume, platy chalk fragments. The underlying material, to a depth of 10 inches, is white platy chalk. Clay loam from the surface layer is in a few fine cracks.

Eddy soils are well drained. Runoff is medium, and permeability is moderately slow. Available water capacity is very low. The hazard of water erosion is moderate.

Representative profile of Eddy gravelly clay loam, 3 to 5 percent slopes, 20 miles west of Seguin on Farm Road 78 to Schertz, 2.7 miles north on Farm Road 1518, 1 mile east on Liveoak Hills subdivision road, then 500 feet into brushy pasture north of road:

A1—0 to 4 inches, grayish-brown (10YR 5/2) gravelly clay loam, dark grayish brown (10YR 4/2) moist; strong, fine and medium, granular structure; hard, firm; many fine roots; about 50 percent, by volume, 0.25 inch to 4 inches in diameter platy chalk fragments; calcareous, moderately alkaline; clear, smooth boundary.

C—4 to 10 inches, white (10YR 8/1) platy chalk with a hardness of less than 3 on the Mohs' scale; few fine roots in crevices; few crevices filled with grayish brown clay loam.

Depth to chalk or soft limestone ranges from 3 to 10 inches. The A horizon is grayish brown, dark grayish brown, brown, or dark brown. It is 35 to 50 percent, by volume, platy chalk fragments that range from 0.25 to 6 inches in diameter. The C horizon is white or very pale brown chalk or soft limestone with a hardness of less than 3 on the Mohs' scale.

EgC—Eddy gravelly clay loam, 3 to 5 percent slopes. This gently sloping soil is on both narrow and broad, irregularly shaped, convex ridges. Areas range from about 10 to 150 acres in size. Slopes are mainly convex and have a gradient that averages about 4 percent. In a few places, the slopes are single (fig. 12).

Included with this soil in mapping are spots of Doss and Austin soils which are deeper over chalk and are less sloping than this soil. These spots are less than 3 acres in size. They make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. The soil is mainly in native range. Suburban development has expanded to some areas. The soil is not suited to cultivated crops and is poorly suited to improved pasture grasses because of the shallow depth to chalk. Live oak trees make this soil suited to homesites. Capability unit VIe–3; Chalky Ridge range site.

Figure 12.—**Profile of Eddy gravelly clay loam, 3 to 5 percent slopes, showing the underlying chalk or soft limestone at depths of about 3 to 12 inches.**

Ferris Series

The Ferris series consists of deep, calcareous, strongly sloping to moderately steep, clayey soils on uplands. These soils formed in clayey or shaly clayey material.

In a representative profile the surface layer is olive-gray clay about 7 inches thick. The next layer, about 29 inches thick, is pale-olive, very firm clay that has a few olive-yellow mottles. The underlying material, to a depth of 60 inches, is pale-olive, very firm shaly clay that has a few olive-yellow mottles.

Ferris soils are well drained. Runoff is rapid, and internal drainage and permeability are very slow. Infiltration is rapid when the soils are dry and cracked, but it is very slow when they are wet. Available water capacity is high. The hazard of water erosion is severe.

Representative profile of Ferris clay in an area of Ferris and Heiden soils, 5 to 20 percent slopes, eroded, 9 miles north of Seguin on Texas Highway 123, 2.5 miles east on Farm Road 1339, then 200 feet into brushy pasture north of road:

A1—0 to 7 inches, olive-gray (5Y 5/2) clay, olive (5Y 4/2) moist; moderate, fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; surfaces mulch of fine, discrete, hard aggregates about 0.5 inch thick when dry; calcareous, moderately alkaline; gradual, wavy boundary.

AC—7 to 36 inches, pale-olive (5Y 6/3) clay, olive (5Y 5/3) moist; few, fine, faint, olive-yellow mottles; weak, fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; peds have shiny surfaces; few parallelepipeds tilted more than 10 degrees from horizontal; few intersecting slickensides in lower part; calcareous, moderately alkaline; diffuse, wavy boundary.

C—36 to 60 inches, pale-olive (5Y 6/4) shaly clay, olive (5Y 5/4) moist; few, fine, prominent, olive-yellow mottles; massive; extremely hard, very firm, very sticky and very plastic; few slickensides; few fine gypsum crystals; calcareous, moderately alkaline.

The A1 and AC horizons combined range from 30 to more than 60 inches in thickness. Clay makes up 50 to 60 percent of the soil material between depths of 10 and 40 inches. The A1 horizon is 5 to 10 inches thick. It is dark grayish brown, light brownish gray, or olive gray. The AC horizon is light yellowish-brown, light olive-brown, pale-olive, or olive clay. The C horizon is clay or shaly clay and has blocky rock structure. Calcium carbonate concretions and gypsum crystals are in the AC and C horizons.

FhF3—Ferris and Heiden soils, 5 to 20 percent slopes, eroded. These gently sloping to moderately steep soils are in areas that are mainly long and narrow. Slope in the areas is toward small creeks and drainageways. The areas mainly range from about 10 to 300 acres in size, but a few areas are as large as 800 acres. Slopes are single and convex. Many gullies are present. They are 4 to 12 feet deep, 20 to 40 feet wide, and 20 to 100 feet apart. Scattered chert pebbles are on and in the surface layer in some areas, and these areas are not as eroded as other areas.

The Ferris soil has the profile described as representative of the Ferris series. The Heiden soil has a surface layer of olive-gray clay about 14 inches thick. The next layer is olive clay about 24 inches thick. The underlying material, to a depth of 60 inches, is olive-gray shaly clay.

Ferris clay makes up about 65 percent of most mapped areas, but it ranges from 15 to 90 percent. It is mostly on the steeper slopes and the rims of gullies. Heiden clay makes up about 35 percent of the mapped areas, but it ranges from 10 to 85 percent. It is mostly on foot slopes and in less sloping areas between gullies. Soil areas are not in regular patterns. Included in mapping are a few spots of eroded Altoga and Houston Black soils. The Altoga soil is mainly in steep areas, and the Houston Black soil is on lower slopes.

Runoff is medium to rapid. The hazard of water erosion is severe. The soils are mainly in abandoned, eroded cropland. Some areas are in native range. The soils are not suited to cultivated crops because of slope and erosion. In places areas are suited to improved pasture grasses if gullies are shaped, smoothed, and filled. Capability unit VIe–1; Eroded Blackland range site.

Heiden Series

The Heiden series consists of deep, calcareous, gently sloping to moderately steep, clayey soils on uplands. These soils formed in calcareous clayey or shaly clay materials.

In a representative profile the surface layer is dark grayish-brown, very firm clay about 25 inches thick. The next layer, about 39 inches thick, is olive, very firm clay that has a few olive-yellow mottles and streaks of dark grayish brown in old filled cracks. The underlying material, to a depth of 84 inches, is light olive-gray, very firm, shaly clay.

Heiden soils are well drained. Runoff is medium to rapid. Water enters rapidly when the soils are dry

and cracked, but permeability is very slow when the soils are wet. Available water capacity is high. The hazard of water erosion is moderate to severe.

Representative profile of Heiden clay, 3 to 5 percent slopes, eroded, 8 miles north of Seguin on Texas Highway 123, about 3 miles east on paved county road, then 100 feet into field south of road:

Ap—0 to 6 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; surface mulch of fine, discrete, hard aggregates about 0.5 inch thick when dry; calcareous, moderately alkaline; clear, smooth boundary.

A1—6 to 25 inches, dark grayish-brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; peds have shiny surfaces; few intersecting slickensides in lower part; calcareous, moderately alkaline; diffuse, wavy boundary.

AC—25 to 64 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; few, fine, faint, olive-yellow mottles; moderate, fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; peds have shiny surfaces; few parallelepipeds tilted more than 10 degrees from horizontal; common intersecting slickensides; few streaks of dark grayish-brown clay from A1 horizon in old filled cracks; calcareous, moderately alkaline; diffuse, wavy boundary.

C—64 to 84 inches, light olive-gray (5Y 6/2) shaly clay, olive gray (5Y 5/2) moist; few, fine, distinct, olive-yellow mottles; massive; extremely hard, very firm; few, fine, calcium carbonate concretions; calcareous, moderately alkaline.

The Ap, A1, and AC horizons combined range from about 40 to 64 inches in thickness. The A horizon ranges from 12 to 30 inches in thickness. It is thinnest in the microridges and thickest in the microvalleys. It is dark grayish brown or olive gray. Clay makes up 50 to 60 percent of the soil material between depths of 10 and 40 inches.

The AC horizon is grayish brown, olive gray, olive, or pale olive and is mottled in shades of olive and yellow. Dark grayish-brown or olive-gray streaks are in old filled cracks. The C horizon is pale-olive, light olive-gray, olive-gray, or yellow clay, shaly clay, or marl.

HeB—Heiden clay, 1 to 3 percent slopes. This gently sloping soil is mainly on narrow ridges. Areas range from about 8 to 75 acres in size. Slopes are convex and have a gradient that averages about 2 percent.

The surface layer is dark grayish-brown, very firm clay about 25 inches thick. The next layer is olive, very firm clay. It has a few dark grayish-brown streaks in old filled cracks and a few olive-yellow mottles, and it is 35 inches thick. This layer is underlain, below a depth of 60 inches, by light olive-gray, very firm clay or shaly clay.

Included with this soil in mapping are a few spots of Houston Black soils in about the same position as this Heiden soil. These spots are less than 3 acres in size and make up less than 10 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. The soil is used mainly for growing crops, and it is well suited to this use. It is also suited to improved pasture grasses. Capability unit IIe–1; Blackland range site.

HeC—Heiden clay, 3 to 5 percent slopes. This gently sloping soil is mainly on the sides of hills above small creeks and drainageways. Areas are long, narrow, and curved. They range from 10 to 50 acres in size. Slopes are short and single and have a gradient that averages about 4 percent.

The surface layer is dark grayish-brown, very firm clay about 18 inches thick. The next layer is olive, very firm clay. It has dark grayish-brown streaks in old filled cracks and a few yellow mottles. This layer is about 24 inches thick. It is underlain, below a depth of 42 inches, by pale-olive, very firm shaly clay.

Included with this soil in mapping are spots of Houston Black soils. They are in about the same position as this Heiden soil. These spots are less than 3 acres in size and make up less than 10 percent of the mapped areas.

Runoff is medium when the soil is dry and cracked, but it is rapid when the soil is wet. The hazard of water erosion is moderate. The soil is used mainly for crops, and it is suited to this use. It is also suited to improved pasture grasses. Capability unit IIIe–1; Blackland range site.

HeC3—Heiden clay, 3 to 5 percent slopes, eroded. This gently sloping soil is in areas along small creeks and drainageways (fig. 13). These areas follow the slope contour and are mainly long and narrow. They range from 10 to 200 acres in size. Slopes are single and have a gradient that averages about 4 percent. A few gullies are in most mapped areas. They are mainly 4 to 10 feet wide, 1 to 8 feet deep, and 200 to 500 feet apart. They make up about 10 to 15 percent of the areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Houston Black and Altoga soils that are in about the same position as this Heiden soil. These spots are less than 3 acres in size and make up less than 15 percent of the mapped areas.

Runoff is medium when the soil is dry and cracked, and it is rapid when the soil is wet. The hazard of water erosion is moderate. Much of the soil is in abandoned, eroded cropland. Some areas are cultivated, and the soil is suited to crops if erosion is controlled. It is suited to improved pasture grasses if gullies are shaped, smoothed, and filled. Capability unit IIIe–1; Blackland range site.

HeD3—Heiden clay, 5 to 8 percent slopes, eroded. This sloping soil is on steeper, upper parts of hills. Areas mainly have a narrow, curved shape. They range from 5 to 50 acres in size. Slopes are short and single and have a gradient that averages about 7 percent. A few gullies are in most mapped areas. They are mainly 6 to 10 feet wide, 2 to 8 feet deep, and 200 to 400 feet apart. They make up about 15 to 20 percent of the mapped areas.

The surface layer is olive-gray, very firm clay about 12 inches thick. The next layer is olive, very firm clay that has olive-gray streaks in old filled cracks. It is about 28 inches thick. The underlying material, below a depth of 40 inches, is pale-olive, very firm clay and has a few yellow mottles.

Included with this soil in mapping are a few spots of Altoga, Ferris, and Houston Black soils that are in about the same positions as this Heiden soil. These spots make up less than 10 percent of the mapped areas.

Runoff is rapid. The hazard of water erosion is severe. The soil is used mainly for crops and for

Figure 13.—**Landscape of Heiden clay, 3 to 5 percent slopes, eroded, showing the gentle slopes and the location of the drainageways.**

grazing. It is better suited to improved pasture grasses than to most other uses if gullies are shaped, smoothed, and filled. Capability unit IVe–3; Blackland range site.

Houston Black Series

The Houston Black series consists of deep, calcareous, nearly level to gently sloping, clayey soils on uplands. These soils formed in calcareous clay or marl.

In a representative profile the surface layer is very dark gray, very firm clay about 36 inches thick. The next layer, to a depth of 60 inches, is olive-gray, very firm clay in the upper part and olive, very firm clay in the lower part. It has streaks of very dark gray clay in old filled cracks, and a few yellow mottles are in this layer.

Houston Black soils are moderately well drained. Runoff is slow to rapid. Water enters rapidly when the soils are dry and cracked, but permeability is very slow when the soils are wet. Available water capacity is high. The hazard of water erosion is moderate in sloping areas.

Representative profile of Houston Black clay, 1 to 3 percent slopes, in a microdepression about 16 miles north of Seguin on Texas Highway 123, 4 miles east on Farm Road 621, 0.75 mile east on gravel road, then 100 feet into field south of road:

Ap—0 to 6 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, fine and medium, granular and subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; shiny ped faces; surface mulch of fine, discrete, hard, aggregates about 0.5 inch thick; few siliceous pebbles on surface; few, fine, iron-manganese concretions; calcareous, moderately alkaline; clear, smooth boundary.

A1—6 to 36 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; shiny ped faces; common intersecting slickensides in lower part; parallelepipeds tilted more than 10 degrees from horizontal; few, fine, iron-manganese concretions; calcareous, moderately alkaline; gradual, wavy boundary.

AC1—36 to 48 inches, olive-gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; few, fine, faint, olive mottles; moderate, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; shiny ped faces; common intersecting slickensides; parallelepipeds tilted more than 10 degrees from horizontal; common streaks of very dark gray from A1 horizon in old cracks; few, fine, calcium-carbonate and iron-manganese concretions; calcareous, moderately alkaline; gradual, wavy boundary.

AC2—48 to 60 inches, olive (5Y 5/3) clay, olive (5Y 4/3) moist; few, fine, faint, yellow mottles; weak, fine, blocky structure; very hard, very firm, very sticky and very plastic; shiny ped faces; few intersecting slickensides; parallelepipeds tilted more than 10 degrees from horizontal; few, fine, calcium-carbonate and iron-manganese concretions; calcareous, moderately alkaline.

The A and AC horizons are more than 60 inches thick. Within a horizontal distance of about 8 to 10 feet, the A horizon ranges in thickness from 8 inches in the center of the microknoll to 42 inches in the center of the microdepression. It is dark gray or very dark gray. Reaction is moderately alkaline to mildly alkaline. Siliceous pebbles make up as much as 35 percent, by volume, of the A horizon. Pebbles cover 25 to 80 percent of the surface in places. The highest percentage of pebbles is in the upper few inches. Clay makes up 50 to 60 percent of the soil between depths of 10 and 40 inches. The AC horizon is dark grayish brown or grayish brown to olive yellow, olive gray, olive, or yellow.

HoA—Houston Black clay, 0 to 1 percent slopes. This nearly level soil is in small areas within larger areas of gently sloping Houston Black clay. Areas have an irregular, oval shape, and they generally range from 20 to 200 acres in size.

The surface layer is very dark gray, very firm clay about 40 inches thick. The next layer, to a depth of about 96 inches, is olive-gray, very firm clay in the upper part and olive, very firm clay in the lower part. It has streaks of very dark gray clay in old cracks and a few yellow mottles.

Included with this soil in mapping are spots of Burleson clay that are in about the same positions as this soil. Burleson soils have a crusty surface layer. These spots are 1 to 2 acres in size and make up less than 10 percent of the mapped areas.

Runoff is slow. The hazard of water erosion is slight. The soil is used for cultivated crops. It is suited to improved pasture grasses. Capability unit IIw–1; Blackland range site.

HoB—Houston Black clay, 1 to 3 percent slopes. This gently sloping soil is in large, smooth areas that are 100 to 1,000 acres or more in size. Slopes are single, are 1,000 to 2,000 feet long, and have a gradient that averages about 2 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Burleson, Heiden, and Austin soils. Burleson soils are in low areas and have a crusty surface. Heiden and Austin soils are on low ridges. Austin soils are underlain by chalk. These spots of included soils make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. The soil is used mainly for cultivated crops. It is suited to improved pasture grasses. Capability unit IIe–1; Blackland range site.

HpB—Houston Black gravelly clay, 1 to 3 percent slopes. This gently sloping soil is in areas that range from 20 to 200 acres in size. Some areas are on long, narrow ridges, and others are wide and smooth. Slopes are convex and have a gradient that averages about 2 percent.

The surface layer is very dark gray gravelly clay about 35 inches thick. It is about 30 percent, by volume, chert and flint pebbles that are mainly in the upper 12 inches. Pebbles cover about 60 percent of the surface. The next layer, to a depth of 96 inches, is grayish-brown, very firm clay in the upper part and olive, very firm clay in the lower part. It has streaks of very dark gray clay in old cracks and has olive-yellow mottles.

Included with this soil in mapping are spots of Burleson soils that have a crusty surface and are in about the same position as Houston Black soils. These spots make up less than 10 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is slight. The soil is used mainly for crops. It is suited to improved pasture grasses. The gravel on the surface helps to prevent erosion by breaking the force of falling rain. It also reduces surface evaporation by allowing the surface material to act as a mulch (fig. 14). Capability unit IIe–1; Blackland range site.

HpC—Houston Black gravelly clay, 3 to 5 percent slopes. This gently sloping soil is in long, narrow areas that slope to small drainageways. Areas range from 20 to 300 acres in size. Slopes are single and have a gradient that averages about 4 percent.

The surface layer is very dark gray gravelly clay about 12 inches thick. It is about 30 percent, by volume, chert and flint pebbles that are mainly in the upper 12 inches. Pebbles cover about 70 percent of the surface. The next layer, to a depth of more than 60 inches, is grayish-brown, very firm clay that has a few yellow mottles and has dark-gray streaks in old cracks.

Included with this soil in mapping are spots of Heiden and Burleson soils that are in about the same position as Houston Black soils. Also included in places are some areas of Houston Black soils that are about 35 percent gravel, by volume, in the upper part of the underlying material. The uncluded soils make up less than 10 percent of the mapped areas.

Runoff is medium when the soil is dry and cracked, and rapid when it is wet. The hazard of water erosion is moderate. The soil is used mainly for crops. It is suited to improved pasture grasses. The gravel on the surface helps to prevent erosion and reduces surface evaporation. Capability unit IIIe–1; Blackland range site.

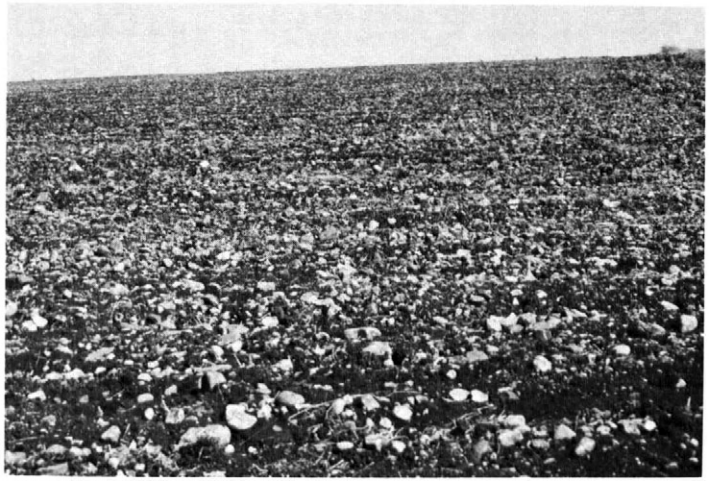


Figure 14.—**Landscape of Houston Black gravelly clay, 1 to 3 percent slopes, showing the large amount of gravel on the surface.**

Jedd Series

The Jedd series consists of moderately deep, noncalcareous, gently sloping to sloping, cobbly, loamy soils on uplands. These soils formed in weakly consolidated to weakly cemented sandstone.

In a representative profile the surface layer is cobbly sandy loam about 10 inches thick. It is brown in the upper part and light yellowish brown in the lower part. It is about 50 percent, by volume, 1- to 4-inch angular sandstone fragments, and about 20 percent of the surface is covered with 4- to 24-inch sandstones and cobbles. The next layer, about 14 inches thick, is red, firm sandy clay that has a few, thin, interbedded layers of sand in the lower part. The underlying material, to a depth of 28 inches, is red, weakly cemented sandstone.

Jedd soils are well drained. Runoff is medium to rapid, and permeability is moderately slow. Available water capacity is low. The hazard of water erosion is moderate.

In Guadalupe County, Jedd soils are mapped only in a complex with Nebgen soils.

Representative profile of Jedd cobbly sandy loam in an area of Nebgen-Jedd complex, 3 to 20 percent slopes, 8 miles southeast of Seguin on Farm Road 466, about 7 miles south on Farm Road 2770, then 150 feet into pasture east of road to ridge:

A1—0 to 6 inches, brown (10YR 5/3) cobbly sandy loam, dark brown (10YR 4/3) moist; weak, medium, granular structure; hard, friable; few fine roots; about 50 percent, by volume, 1- to 4-inch angular sandstone fragments; about 20 percent 4- to 24-inch angular sandstones and cobbles on surface; slightly acid; clear, smooth boundary.

A2—6 to 10 inches, light yellow-brown (10YR 6/4) cobbly sandy loam, yellowish brown (10YR 5/4) moist; weak, medium, granular structure; hard, friable; few fine roots; about 50 percent, by volume, 1- to 4-inch angular sandstone fragments; slightly acid; abrupt, wavy boundary.

B2t—10 to 18 inches, red (2.5YR 5/8) sandy clay, red (2.5YR 4/8) moist; moderate, fine, blocky structure; very hard, firm; few fine roots; few fine pores; few thin clay films on ped faces; medium acid; clear, wavy boundary.

B3—18 to 24 inches, red (2.5YR 5/8) sandy clay, red (2.5YR 4/8) moist; weak, fine, blocky structure; very hard, firm; few fine pores; few thin clay films on ped faces; few thin interbedded layers of brownish-yellow sand; strongly acid; abrupt, wavy boundary.

C—24 to 48 inches, red (2.5YR 5/8) and brownish-yellow (10YR 6/8) weakly cemented sandstone; strongly acid.

The solum ranges from 20 to 26 inches in thickness. The A horizon ranges from 10 to 12 inches in thickness. The A1 horizon is brown or dark brown. The A2 horizon is light brown, light yellowish brown, or yellowish brown. The A horizon is gravelly or cobbly sandy loam or loamy sand. It is 30 to 50 percent, by volume, sandstone fragments.

The B horizon ranges from 10 to 16 inches in thickness. It is red, reddish brown, or yellowish red. The B3 horizon has a few brownish-yellow mottles. Clay makes up 35 to 45 percent of the B horizon. Reaction ranges from strongly acid to medium acid.

The C horizon is red, reddish-yellow, reddish-brown, or yellow sandstone that is weakly cemented.

Lewisville Series

The Lewisville series consists of deep, calcareous, nearly level to gently sloping, clayey soils on stream terraces. These soils formed in ancient, calcareous, clayey alluvium.

In a representative profile the surface layer is dark grayish-brown silty clay about 13 inches thick. The next layer, about 47 inches thick, is brown, firm silty clay in the upper part; yellowish-brown, firm silty clay in the middle part; and light yellowish-brown, friable silty clay loam in the lower part. The lower part is about 10 percent, by volume, soft masses, threads, and concretions of lime and contains a few limestone pebbles.

Lewisville soils are well drained. Runoff is slow to medium, internal drainage is medium, and permeability is moderate. Available water capacity is high. The hazard of water erosion is slight to moderate.

Representative profile of Lewisville silty clay, 0 to 1 percent slopes, 13 miles west of Seguin on Interstate Highway 10, 1 mile south on Zuehl Road to Texas Luthern College Farm, 0.25 mile east on gravel road, then 200 feet into field north of road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular structure; hard, friable; few snail-shell fragments; calcareous, moderately alkaline; clear, smooth boundary.

A1—6 to 13 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular, and very fine, subangular blocky structure; hard, firm; few snail-shell fragments; calcareous, moderately alkaline; clear, smooth boundary.

B2—13 to 29 inches, brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate, very fine, subangular blocky structure; hard, firm; few snail-shell fragments; calcareous, moderately alkaline; clear, smooth boundary.

B2ca—29 to 37 inches, yellowish-brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate, very fine, subangular blocky structure; hard, firm; few snail-shell fragments; few wormcasts; about 5 percent, by volume, fine calcium-carbonate concretions; calcareous; moderately alkaline; clear boundary.

B3ca—37 to 60 inches, light yellowish-brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak, fine, blocky structure; slightly hard, friable; about 10 percent, by volume, soft masses and concretions of calcium carbonate; few limestone pebbles; calcareous, moderately alkaline.

The solum ranges from 30 to 70 inches in thickness. Clay makes up 35 to 45 percent of the soil material between depths of 10 and 40 inches, but the average is about 40 percent. About 5 to 15 percent of the clay is carbonate clay. Calcium carbonate equivalent ranges from 20 to 40 percent.

The A horizon ranges from 8 to 20 inches in thickness. It is dark brown, dark grayish brown, or very dark grayish brown.

The B2 horizon is brown, dark grayish-brown, or yellowish-brown silty clay or clay loam. The B3ca horizon, where present, is reddish-yellow, very pale brown, or light yellowish-brown silty clay, clay loam, or silty clay loam. The B2ca horizon and B3ca horizon are 5 to 10 percent, by volume, threads, masses, and concretions of calcium carbonate and snail-shell fragments.

LeA—Lewisville silty clay, 0 to 1 percent slopes. This nearly level soil is mainly on terraces in large areas that have a broad, irregular shape. A few smaller areas are oval. Areas range from 10 to as much as 500 acres in size. The profile of the soil is the one described as representative of the series.

Included with this soil in mapping are spots of Bar-

barosa, Sunev, Branyon, and Queeny soils. Barbarosa and Branyon soils are in low areas. Sunev soils are on low knolls and ridges above Lewisville soils. Queeny soils occur as shallow spots. These spots are less than 3 acres in size.

Runoff is slow. The hazard of water erosion is slight. The soil is used for crops. It is suited to improved pasture grasses and to irrigation if water is available. Capability unit I–1; Clay Loam range site.

LeB—Lewisville silty clay, 1 to 3 percent slopes. This gently sloping soil is on terraces in long, narrow areas that slope to small drainageways. Areas are about 10 to 50 acres in size. Slopes are single and have a gradient that averages about 2 percent.

The surface layer is dark grayish-brown silty clay about 10 inches thick. The next layer is more than 50 inches thick. The upper part is brown, friable silty clay. The lower part is yellowish-brown, very friable silty clay loam and is about 5 percent, by volume, masses and concretions of lime.

Included with this soil in mapping are a few spots of Barbarosa, Sunev, and Queeny soils. The Barbarosa and Sunev soils are in about the same position as Lewisville soils. Queeny soils occur as shallow spots. These spots are less than 2 acres in size.

Runoff is medium. The hazard of water erosion is moderate. The soil is used mainly for crops. It is suited to improved pasture grasses. Capability unit IIe–2; Clay Loam range site.

Mabank Series

The Mabank series consists of deep, noncalcareous, nearly level to gently sloping, loamy soils on uplands. These soils formed in calcareous clay and shale material.

In a representative profile the surface layer is dark-gray loam about 10 inches thick. The next layer, to a depth of 66 inches, is very dark gray, very firm clay loam in the upper part; dark-gray, very firm clay in the middle part; and gray, very firm clay in the lower part.

Mabank soils are somewhat poorly drained. Runoff is slow to medium, and internal drainage and permeability are very slow. Available water capacity is medium. The hazard of water erosion is slight to moderate.

Representative profile of Mabank loam, 0 to 1 percent slopes, 3 miles north of Seguin on Texas Highway 123, about 2 miles east on Farm Road 20, about 1 mile east on gravel road, then 150 feet into pasture south of road:

A1—0 to 10 inches, dark-gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; massive dry, weak, fine, granular structure moist; very hard, firm; few fine roots; thin, light-gray surface crust when dry; neutral; abrupt, wavy boundary.

B21tg—10 to 24 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate, medium and coarse, blocky structure; extremely hard, very firm; few fine roots; thin clay films on ped faces; few streaks of dark-gray loam from A1 horizon in old filled cracks; few siliceous pebbles; few, fine, iron-manganese concretions; neutral; gradual, smooth boundary.

B22tg—24 to 40 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, coarse, blocky structure; extremely hard, very firm; few fine roots in upper part; thin clay films on ped faces; few streaks of dark-gray loam from A1 horizon in old filled cracks; few, fine, iron-manganese concretions; few siliceous pebbles; mildly alkaline; gradual, smooth boundary.

B23tg—40 to 66 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few, fine, faint, brownish-yellow mottles; weak, coarse, blocky structure; extremely hard, very firm; thin clay films on ped faces; few, fine, calcium-carbonate concretions; common siliceous pebbles; mildly alkaline.

The solum is more than 60 inches thick. The A horizon ranges from 4 to 12 inches in thickness. It is dark gray or dark grayish brown. It has a thin light-gray or light brownish-gray surface crust when dry. Reaction in the A horizon ranges from slightly acid to neutral.

Clay makes up 35 to 50 percent of the soil material between depths of 10 and 40 inches. The Btg horizon is clay or clay loam. Cracks more than 0.4 inch wide extend from the top of the B21tg horizon to a depth of 24 inches or more in some season in most years. The B21tg horizon is very dark gray or dark gray. The B22tg horizon is dark gray or grayish brown. The B23tg horizon is gray or grayish brown. Mottles in shades of red, brown, and yellow are in the lower part of the B22tg and the B23tg horizons in places. Reaction in the B21tg horizon ranges from neutral to mildly alkaline. In the B22tg and B23tg horizons it ranges from neutral to moderately alkaline.

MaA—Mabank loam, 0 to 1 percent slopes. This nearly level soil is in areas that range from about 15 to 100 acres in size. Most areas have an irregular, oval shape. Slopes are single and have a gradient that averages about 0.5 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are small spots of Crockett and Burleson soils that are in about the same position as Mabank soils. These spots make up less than 15 percent of the mapped areas.

Runoff is slow. The hazard of water erosion is slight. Most areas of this soil are cultivated. A few areas in the southwestern part of the county are used for peanuts. The soil is suited to improved pasture grasses. It stays wet for short periods following heavy rain because runoff is slow, and permeability in the clayey lower layers is very slow. Capability unit IIIw–1; Claypan Prairie range site.

MaB—Mabank loam, 1 to 3 percent slopes. This gently sloping soil is in areas that have an irregular, oval shape and in areas that are long and narrow. Areas range from about 10 to 100 acres in size. Slopes are both concave and convex and have a gradient that averages about 2 percent.

The surface layer is a dark-gray loam about 6 inches thick. The next layer, to a depth of 72 inches, is very firm clay. The upper part is very dark gray, and the lower part is dark gray and has a few brown mottles and small lime concretions.

Included with this soil in mapping are spots of Crockett and Burleson soils that are in about the same position as Mabank soils. These spots make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. Much of this soil is in abandoned cropland. Brush infestation is a concern. A few areas are used for crops. The soil is better suited to improved pasture grasses, if brush is controlled, than to most other uses. Capability unit IIIe–3; Claypan Prairie range site.

MaB3—Mabank loam, 1 to 3 percent slopes, eroded.

This gently sloping soil is in areas that have an irregular, oval shape and in areas that are long and narrow. Areas range from about 10 to 80 acres in size. Slopes are both single and convex and have a gradient that averages about 2 percent. The surface layer has been removed in about 25 to 40 percent of most mapped areas. Many areas contain a few gullies that are mainly 6 to 10 feet wide, 2 to 8 feet deep, and 200 to 400 feet apart. The gullies make up about 10 to 15 percent of the mapped areas.

The surface layer in most areas is dark-gray loam about 14 inches thick. The next layer, to a depth of more than 60 inches, is very firm clay. The upper part is very dark gray, and the lower part is grayish brown and has yellowish mottles. Interbedded sand and clay is below a depth of about 7 feet in most places.

Included with this soil in mapping are a few spots of Crockett, Heiden, and Windthorst soils that are in about the same position as Mabank soils. The spots make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. The soil is mainly in abandoned, eroded cropland. Brush infestation is a concern. A few areas are used for grazing crops. The soil is better suited to improved pasture grasses than to most other uses if gullies are shaped, smoothed, and filled and brush is controlled. Capability unit IVe–2; Claypan Prairie range site.

Nebgen Series

The Nebgen series consists of very shallow to shallow, noncalcareous, gently sloping to moderately steep, cobbly, loamy soils on uplands. These soils formed in noncalcareous, loamy material weathered from sandstone.

In a representative profile the surface layer is reddish-brown, cobbly sandy loam about 7 inches thick. It is about 25 percent, by volume, 1- to 10-inch angular sandstone fragments. About 20 percent of the surface is covered with 4- to 24-inch angular sandstones and cobbles. The underlying material, to a depth of 14 inches, is reddish-brown, strongly cemented sandstone.

Nebgen soils are well drained. Runoff is rapid, and permeability is moderately rapid. Available water capacity is very low. The hazard of water erosion is moderate.

Representative profile of Nebgen cobbly sandy loam in an area of Nebgen-Jedd complex, 3 to 20 percent slopes, about 10 miles south of Seguin on Texas Highway 123, about 4 miles southeast of Weinert Ranch Road, then 300 feet west on stony ridge:

A1—0 to 7 inches, reddish-brown (5YR 5/3) cobbly sandy loam, reddish brown (5YR 4/3) moist; weak, medium, granular structure; hard, friable; few fine roots; about 25 percent, by volume, 1- to 10-inch angular sandstone fragments; about 20 percent of surface covered with 4- to 24-inch angular sandstones and cobbles; slightly acid; clear, wavy boundary.

C—7 to 14 inches, reddish-brown (5YR 5/4), strongly cemented sandstone; fractured in upper part; a few crevices filled with sandy loam; weakly cemented moist; strongly acid.

The A horizon ranges from 4 to 12 inches in thickness. It is brown, dark-brown, or reddish-brown cobbly or stony sandy loam. It is 15 to 25 percent, by volume, sandstones and cobbles.

The C horizon is reddish or brownish acid sandstone that is strongly cemented when dry and weakly cemented when moist.

NcF—Nebgen-Jedd complex, 3 to 20 percent slopes. These gently sloping to moderately steep soils are on small knolls and ridges. The knolls are oval and range from about 6 to 40 acres in size. The ridges are long and narrow and range from 50 to 175 acres in size. Slopes are convex and have a gradient that ranges from 3 to 30 percent. In places as much as 60 to 75 percent of the surface is covered with sandstones and boulders that are mainly 2 to 8 feet in diameter.

The areas of Nebgen and Jedd soils are so intricately mixed and so small in size that they cannot be shown separately on the soil map. Mapped areas are about 53 percent Nebgen cobbly sandy loam and 40 percent Jedd cobbly sandy loam. The other 7 percent is a soil similar to this Jedd soil that has sandstone at a depth of 10 to 20 inches. In most mapped areas the Nebgen soil is on sides of knolls and ridges where slopes are about 8 to 20 percent. The Jedd soil is mainly on tops of knolls and ridges where slopes range from 3 to 8 percent. In some mapped areas Nebgen and Jedd soils are on tops and sides of knolls and ridges. Included in mapping are a few areas on the sides of ridges where short slopes are as much as 60 percent.

Runoff is rapid. The hazard of water erosion is moderate. The soils are in native range. They are not suited to crops or improved pasture because of stoniness and slope (fig. 15). Capability unit VIIs–1; Sandstone Hills range site.

Patilo Series

The Patilo series consists of deep, noncalcareous, gently sloping to sloping, sandy soils on uplands. These soils formed in thick sandy beds that appear to have been reworked by wind.

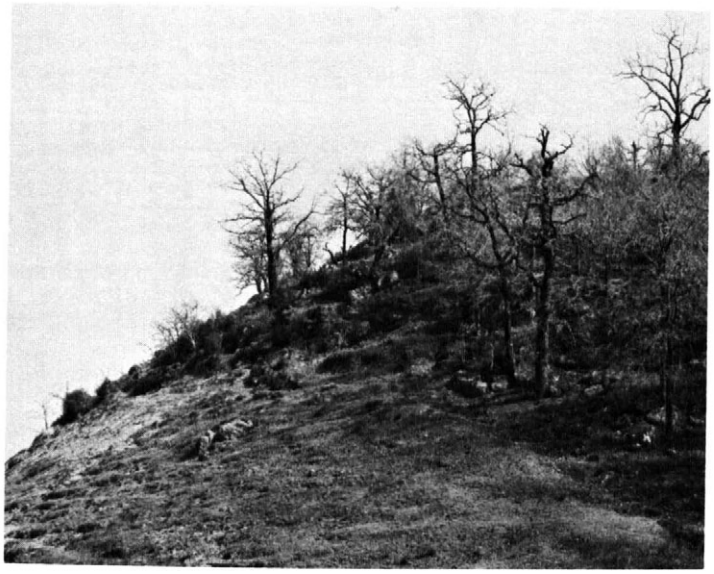


Figure 15.—**Landscape of Nebgen-Jedd complex, 3 to 20 percent slopes, showing sandstone, cobblestones, and boulders on the surface.**

In a representative profile the surface layer is loose, fine sand about 52 inches thick. It is light brownish gray in the upper part and very pale brown in the lower part. The next layer, to a depth of 84 inches, is mottled brownish-yellow, light brownish-gray, and red, strongly acid, firm sandy clay loam in the upper part and yellowish-red, strongly acid, firm sandy clay loam in the lower part. The lower part has a few strong-brown and light brownish-gray mottles.

Patilo soils are moderately well drained. Runoff is very slow, permeability is rapid in the surface layer, and internal drainage and permeability in the lower layers are moderately slow. Available water capacity is low. The hazard of water erosion is slight.

Representative profile of Patilo fine sand in an area of Patilo and Arenosa soils, 1 to 8 percent slopes, about 8 miles southeast of Seguin on Farm Road 466, 8 miles south on Farm Road 2770, 1.3 miles east on gravel road, then 500 feet into woody range north of road:

A1—0 to 8 inches, light brownish-gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grained; loose; few fine roots; neutral; clear, smooth boundary.

A2—8 to 52 inches, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots; neutral; clear, wavy boundary.

B2t—52 to 68 inches, mottled brownish-yellow (10YR 6/6), light brownish-gray (2.5Y 6/2), and red (2.5YR 4/8) sandy clay loam; weak, medium, blocky structure; hard, firm; common fine roots; few fine pores; few thin clay films on ped faces and in pores; strongly acid; gradual, wavy boundary.

B3—68 to 84 inches, yellowish-red (5YR 5/8) sandy clay loam, yellowish red (5YR 5/8) moist; few, fine, distinct, strong-brown mottles and few, fine, prominent, light brownish-gray mottles; weak, medium, blocky structure; hard, firm; few fine pores; few thin clay films on ped faces and in pores; strongly acid.

The solum is more than 84 inches thick. The A horizon ranges from 40 to 80 inches in thickness. The A1 horizon is grayish brown, brown, light brownish gray, pale brown, or light yellowish brown. The A2 horizon is very pale brown, light-gray, or white sand in most places, but it ranges to loamy fine sand in a few places. Reaction is slightly acid or neutral.

The B horizon is sandy clay loam that is 25 to 35 percent clay. The B2t horizon ranges from 8 to 25 inches in thickness. Color of the matrix ranges from mottles in shades of red, gray, brown, and yellow to brownish yellow with mottles in shades of red and gray. The B3 horizon is red, yellowish red, or brownish yellow. Mottles are in shades of red, gray, brown, or yellow. Reaction in the B horizon is strongly acid or medium acid.

PaD—Patilo and Arenosa soils, 1 to 8 percent slopes. These gently sloping to strongly sloping soils are in large, irregularly shaped areas. Many areas are several thousand acres in size. Slopes are concave and convex and have a gradient that averages about 4 percent in most areas.

The Patilo soil has the profile described as representative of the Patilo series. The Arenosa soil has a surface layer of pale-brown fine sand about 6 inches thick. The underlying material, to a depth of 90 inches, is very pale brown fine sand.

Patilo fine sand makes up about 49 percent of most mapped areas, but the range is from as little as 20 to as much as 80 percent. Arenosa fine sand generally makes up 29 percent, but in places makes up as much as 80 percent. A soil similar to Patilo fine sand makes up about 22 percent of the mapped areas. It has a sandy surface layer less than 40 inches thick. The Patilo soil is in all mapped areas, but the Arenosa soil is not. Arenosa fine sand is on the middle and upper parts of hills, Patilo fine sand is on the middle and lower parts of hills, and the soil similar to Patilo fine sand is in narrow valleys and along small drainageways.

These soils have little or no runoff. The hazard of water erosion is slight. The soils are used mainly for native range and for recreation. Native trees provide food and protection for wildlife. The soils are droughty and low in natural fertility. They are suited to specialty crops and improved pasture grasses if they are fertilized and moisture is adequate or if they are irrigated. Capability unit IVs–1; Deep Sand Savannah range site.

Queeny Series

The Queeny series consists of very shallow to shallow, calcareous, gently sloping to moderately steep, gravelly loamy soils on ancient stream terraces. These soils formed in thick beds of gravel and sand deposited by ancient streams.

In a representative profile the surface layer is very dark grayish-brown gravelly loam about 9 inches thick. The upper part of the underlying material is very pale brown, strongly cemented platy caliche about 8 inches thick; the next part is a white, weakly cemented caliche about 20 inches thick; and the lower part, to a depth of 144 inches, is very gravelly sand.

Queeny soils are well drained. Runoff is medium to rapid. Permeability is moderate in the surface layer and slow in the caliche layer. Available water capacity is very low. The hazard of water erosion is slight to moderate.

Representative profile of Queeny gravelly loam, 1 to 5 percent slopes, 1.5 miles east of Seguin on U.S. Highway 90A to west edge of Seguin Auxiliary Airfield, 0.2 mile south on paved road, then 400 feet west along west face of gravel pit:

A1—0 to 9 inches, very dark grayish-brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, granular structure; hard, friable; common fine roots; about 15 percent siliceous pebbles; few limestone pebbles on surface and in horizon; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—9 to 17 inches, very pale brown (10YR 8/3), strongly cemented platy caliche that has common, embedded, siliceous and limestone pebbles; caliche plates are mainly 4 to 15 inches long and 1 to 2 inches thick; few fine crevices and solution channels filled with very dark grayish-brown loam in the upper plates; clear, wavy boundary.

C2ca—17 to 37 inches, white (10YR 8/2) weakly cemented, massive caliche that has common, embedded, siliceous and limestone pebbles; clear, wavy boundary.

IIC3—37 to 144 inches, very gravelly sand, about 60 to 70 percent, by volume, siliceous and limestone pebbles and 30 to 40 percent, by volume, brownish-yellow (10YR 6/6) and light-gray (10YR 7/2) fine sand; pebbles are mainly 0.125 to 1 inch in diameter; some fine sand is in interbedded layers that are 0.25 inch to 4 inches thick and 2 to 6 inches apart;

few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 4 to 12 inches in thickness. The A horizon is 12 to about 25 percent, by volume, siliceous pebbles and stones and a few limestone pebbles. Calcium carbonate equivalent is 1 to 5 percent. The A horizon is grayish brown, dark grayish brown, very dark grayish brown, or dark brown.

The C1cam horizon is 2 to 18 inches thick. It has an estimated hardness of 2 to 3 on Mohs' scale and is uniformly plugged with carbonates. The C2ca horizon is 20 to 96 inches thick. It is massive caliche that is indurated or soft. The IIC horizon ranges from 50 to 80 percent, by volume, pebbles that are chert, quartz, jasper, quartzite, limestone, and silicified wood and 20 to 50 percent calcareous, brownish-yellow and light-gray fine sand. The pebbles are mainly 0.125 to 0.75 inch in diameter, but they range to as much as 3 inches in diameter. Some of the fine sand is in interbedded layers that are 0.25 inch to 4 inches thick and 2 to 6 inches apart.

QeC—Queeny gravelly loam, 1 to 5 percent slopes. This gently sloping soil is mainly on terraces. Most areas are long and narrow, but some have an irregular, oval shape. They range from about 5 to 30 acres in size. Slopes are convex and have a gradient that averages about 3 percent. This soil has the profile described as representative of the series (fig. 16). The gravel content of the surface layer is variable and ranges from practically none to about 25 percent, by volume, in small areas.

Included with this soil in mapping are spots of Quihi, Lewisville, and Sunev soils. These soils are in about the same position as Queeny soils, but they have a thicker solum overlying the gravel bed. These spots are less than 2 acres in size.

Runoff is medium. The hazard of water erosion is slight. The soil is used mainly as a source of gravel for road construction. A few areas are used for grazing crops. The soil is poorly suited to cultivated crops or improved pasture grasses because of the depth to the gravel and sand beds. Capability unit IVs–2; Chalky Ridge range site.

QeF—Queeny gravelly loam, 5 to 20 percent slopes. This sloping to moderately steep soil is on narrow, steep escarpments where high terraces break to bottom lands or to low terraces. Areas are about 200 to 300 feet wide and range from about 10 to 15 acres in size. The slopes are single and short.

The surface layer is dark grayish-brown gravelly loam about 6 inches thick. It is about 20 to 25 percent, by volume, limestone and chert pebbles and caliche fragments. It is underlain by beds of limestone gravel and sand to a depth of 8 feet. The upper 2 to 10 inches of gravel has been cemented with lime into a hard platy layer.

Included with this soil in mapping are spots of Altoga and Quihi soils. Altoga soils are in about the same position as Queeny soils. Quihi soils are on the edge of the terraces above the escarpments. Also included are spots where the cemented upper part of the gravel bed is exposed at the surface. These spots are less than 2 acres in size.

Runoff is rapid. The hazard of water erosion is moderate. The soil is used mainly as a source of gravel for road construction. It is not suited to cultivated crops and is poorly suited to improved pasture grasses because of slope or the depth to gravel beds. Capability unit VIs–1; Chalky Ridge range site.

Figure 16.—**Profile of Queeny gravelly loam, 1 to 5 percent slopes, showing the underlying gravel and sand.**

Quihi Series

The Quihi series consists of moderately deep, noncalcareous, gently sloping, gravelly loamy soils on uplands. These soils formed in very gravelly, loamy to clayey, ancient alluvial sediment.

In a representative profile the surface layer is dark grayish-brown gravelly loam about 12 inches thick. It is about 50 percent, by volume, limestone and siliceous pebbles that are mainly less than 3 inches in diameter. The next layer is 26 inches thick. The upper 16 inches is red, firm very gravelly clay and is about 75 percent, by volume, limestone and siliceous pebbles. The lower 10 inches is red gravelly clay and is about 40 percent limestone and siliceous pebbles. It is underlain by very pale brown, strongly cemented platy

caliche about 10 inches thick. Below this is a loose gravel bed.

Quihi soils are well drained. Runoff is medium. Permeability is moderately slow. Available water capacity is low. The hazard of water erosion is slight.

Representative profile of Quihi gravelly loam in an area of Quihi soils, 1 to 5 percent slopes, 11 miles north of Seguin on Texas Highway 123, 1.2 miles west on gravel road, then 100 feet north of road to gravel pit:

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular structure; hard, friable; common fine roots; about 50 percent, by volume, limestone and siliceous pebbles that are 0.25 inch to 3 inches in diameter; few 3- to 5-inch cobbles; mildly alkaline; abrupt, wavy boundary.

B21t—12 to 28 inches, red (2.5YR 4/6) very gravelly clay, dark red (2.5YR 3/6) moist; moderate, fine, angular blocky structure; very hard, firm; few fine roots; few fine pores, about 75 percent, by volume, limestone and siliceous pebbles that are mainly less than 1 inch in diameter; few 1- to 4-inch pebbles and cobbles; thin clay films on ped faces, in pores, and on pebbles; mildly alkaline; clear, wavy boundary.

B22t—28 to 38 inches, red (2.5YR 4/6) gravelly clay, dark red (2.5YR 3/6) moist; moderate, fine, angular blocky structure; very hard, firm; few fine roots; few fine pores; few, fine, iron-manganese concretions; about 40 percent, by volume, limestone and siliceous pebbles that are mainly less than 1 inch in diameter; thick clay films on ped faces, in pores, and on pebbles; mildly alkaline; abrupt, wavy boundary.

C1cam—38 to 48 inches, very pale brown (10YR 8/3), strongly cemented platy caliche containing a few embedded limestone pebbles; extremely hard, extremely firm; caliche fragments are mainly 4 to 10 inches long and 1 inch to 2 inches thick; few fine crevices and solution channels filled with red clay; caliche has a hardness of about 2.5 on Mohs' scale; calcareous; moderately alkaline; clear, wavy boundary.

IIC2—48 to 240 inches, loose gravel bed that is about 75 percent, by volume, limestone pebbles mainly less than 1 inch in diameter and 25 percent, by volume, brownish-yellow (10YR 6/6) and light-gray (10YR 7/2) sand, silt, and clay; few soft masses of calcium carbonate; calcareous, moderately alkaline.

Depth to the petrocalcic horizon ranges from 20 to 40 inches. Coarse fragments of limestone and siliceous pebbles in the solum range from 35 to 80 percent, by volume.

The A horizon ranges from 7 to 14 inches in thickness. It is dark-brown or dark grayish-brown gravelly loam or gravelly clay loam. Reaction is neutral or mildly alkaline.

The B2t horizon is red, reddish brown, or dark reddish brown, and the lower part has yellowish-red mottles in places. It is gravelly or very gravelly clay or clay loam and is 36 to 47 percent clay. Reaction in the B2t horizon is neutral to moderately alkaline.

The Ccam horizon ranges from strongly cemented platy caliche to weakly cemented calcium carbonate. The IIC horizon ranges from 8 to more than 20 feet in thickness. It is 20 to 80 percent gravel, by volume. A few large boulders are in the lower part of the IIC horizon in places.

QgC—Quihi soils, 1 to 5 percent slopes. These gently sloping soils are in irregularly shaped areas that range from about 10 to 150 acres in size. Slopes are convex and have a gradient that averages about 3 percent. The surface layer ranges from gravelly loam to gravelly clay loam in most mapped areas (fig. 17).

Included with these soils in mapping are spots of Queeny soils less than 3 acres in size. They are in about the same position as Quihi soils.

These soils are used mainly as a source of gravel for road construction (fig. 18). A few areas are used for grazing crops and improved pasture grasses, although the soils are poorly suited to these uses. The gravel content causes the soils to be droughty. Capability unit IVs–2; Chalky Ridge range site.

Figure 17.—**Profile of Quihi soils, 1 to 5 percent slopes, showing the gravel in the soil and the underlying gravel beds.**

Seguin Series

The Seguin series consists of deep, calcareous, nearly level, loamy soils on bottom lands. These soils formed in loamy alluvium.

In a representative profile the surface layer is dark grayish-brown silty clay loam about 13 inches thick. The next layer is grayish-brown, friable silty clay loam about 13 inches thick. The underlying material, to a depth of 62 inches, is light brownish-gray, very friable silty clay loam that has a few thin sandy strata.

Seguin soils are well drained. Runoff is slow, internal drainage is medium, and permeability is moderate. Available water capacity is high. Many areas are

Figure 18.—**Gravel pit on Quihi soils, 1 to 5 percent slopes. The underlying gravel beds are a good source of gravel.**

subject to overflow at least once each year. Other areas, protected by dams, are subject to overflow only about every 10 to 50 years. The hazard of water erosion is slight.

Representative profile of Seguin silty clay loam, 300 feet north of river channel in flood plain of Guadalupe River, 0.3 mile northeast of the Texas Highway 123 river bridge in Seguin:

A1—0 to 13 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular, and very fine, subangular blocky structure; hard, friable; common fine roots; few fine pores; common wormcasts; few, medium, snail-shell fragments; calcium carbonate equivalent about 40 percent; calcareous; moderately alkaline; gradual, smooth boundary.

B2—13 to 26 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, granular structure; slightly hard, friable; few fine roots; few fine pores; few wormcasts; few, fine, snail-shell fragments; few films and threads of calcium carbonate; few discontinuous strata of very fine sandy loam in lower part; calcium carbonate equivalent about 45 percent; calcareous; moderately alkaline; gradual, smooth boundary.

C—26 to 62 inches, light brownish-gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; few fine roots in upper part; few films and threads of calcium carbonate; common ⅛- to 4-inch strata of very fine sandy loam, silt loam, and silty clay loam; calcium carbonate equivalent about 45 percent; calcareous; moderately alkaline.

The soil material is 18 to 30 percent silicate clay. Calcium carbonate equivalent ranges from 40 to 60 percent.

The A1 horizon ranges from 8 to 18 inches in thickness. It is dark grayish brown, dark brown, grayish brown, or brown.

The B2 horizon ranges from 5 to 24 inches in thickness. It is grayish brown, brown, or pale brown. The C horizon is light brownish gray, pale brown, or very pale brown. Texture of an individual stratum in the C horizon ranges from loamy very fine sand to silty clay, and a few strata are as much as 15 percent limestone pebbles.

Se—Seguin silty clay loam. This nearly level soil is on flood plains. Many areas are protected from flooding by dams, however, and the soil is subject to flooding only in spring or in fall. The flooding lasts for less than 2 days and occurs once every 10 to 50 years (fig. 19). Areas are long and narrow and range from about 10 to 200 acres in size. The soil is slightly undulating in native bottoms, with a series of low ridges and valleys. The small ridges have been smoothed in cultivated fields. Slopes have a gradient of about 0.5 percent.

Included with this soil in mapping are spots of

Figure 19.—**Profile of Seguin silty clay loam showing the dark layers deposited by floodwaters.**

Bosque and Trinity soils. Bosque soils are in about the same position as Seguin soils, and Trinity soils are in low areas of old channels. These spots are generally less than 2 acres in size and make up less than 15 percent of the mapped areas.

This soil is well suited to cultivated crops, improved pasture grasses, pecans, and recreational areas. It is also suited to irrigation. Large pecan trees provide shade for cattle and recreational areas and food and protection for wildlife. Capability unit I–1; Loamy Bottomland range site.

Sunev Series

The Sunev series consists of deep, calcareous, nearly level to gently sloping, loamy soils on stream terraces. These soils formed in loamy alluvium.

In a representative profile the surface layer is dark grayish-brown loam about 12 inches thick. The next layer, about 48 inches thick, is brown, friable loam in the upper part and very pale brown, very friable loam in the lower part. The underlying material, to a depth of 72 inches, is very pale brown, very friable loam.

Sunev soils are well drained. Runoff is slow to medium, internal drainage is medium, and permeability is moderate. Available water capacity is medium. The hazard of water erosion is slight to moderate.

Representative profile of Sunev loam, 1 to 3 percent slopes, 5 miles west of Seguin on Farm Road 78 to McQueeny, 4 miles northwest on Farm Road 725, 0.8 mile east on gravel road, then 300 feet into field south of road:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, granular structure; hard, friable; thin, light brownish-gray surface crust; common wormcasts; few snail-shell fragments; calcareous, moderately alkaline; abrupt, smooth boundary.

A1—6 to 12 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; strong, fine and medium, granular structure; hard, friable; common wormcasts and holes; few, fine, calcium-carbonate threads; few snail-shell fragments; calcium carbonate equivalent of 36 percent; calcareous, moderately alkaline; gradual, smooth boundary.

B2ca—12 to 21 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; strong, medium, granular and very fine, subangular blocky structure; hard, friable; common wormcasts and holes; many fine calcium-carbonate threads; few snail-shell fragments; calcium carbonate equivalent of 50 percent; calcareous, moderately alkaline; gradual, smooth boundary.

B3ca—21 to 60 inches, very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; strong, very fine, granular structure; slightly hard, very friable; few wormcasts and holes; many fine calcium-carbonate threads; few snail-shell fragments; calcium carbonate equivalent of 64 percent; calcareous, moderately alkaline; diffuse, smooth boundary.

Cca—60 to 72 inches, very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable; many calcium-carbonate films and threads; few, fine, snail-shell fragments; calcium carbonate equivalent about 65 percent; calcareous, moderately alkaline.

The solum ranges from 40 to 70 inches in thickness. Calcium carbonate equivalent between depths of 10 and 40 inches is 40 to 70 percent. Silicate clay makes up 18 to 30 percent of the soil material, and carbonate clay makes up 2 to 10 percent of it. The A horizon is 10 to 20 inches thick. It is dark grayish brown, dark brown, grayish brown, or brown.

The Bca horizon is brown, pale brown, very pale brown, yellowish brown, reddish yellow, or light yellowish brown. It is loam, clay loam, or silty clay loam. The C horizon is very pale brown or reddish-yellow fine sandy loam, loam, clay loam, or silty clay loam.

SuA—Sunev loam, 0 to 1 percent slopes. This nearly level soil is mainly on low terraces that are not subject to flooding. Areas have a somewhat irregular oval shape. They are mainly about 10 to 100 acres in size, but a few areas are as large as 300 acres. Slopes are single and have a gradient that averages about 0.5 percent.

The surface layer is dark grayish-brown loam about 17 inches thick. The next layer is brown loam about 43 inches thick. The underlying material, to a depth of 72 inches, is very pale brown loam.

Included with this soil in mapping are a few spots of Lewisville and Queeny soils. Lewisville soils are in low areas, and Queeny soils are on shallow ridges or knolls. These spots are less than 2 acres in size.

Runoff is slow. The hazard of water erosion is slight. The soil is cultivated, and it is suited to crops and improved pasture grasses. It is also suited to irrigation, if water is available. Capability unit IIs–1; Clay Loam range site.

SuB—Sunev loam, 1 to 3 percent slopes. This gently sloping soil is on low terraces mainly in long, narrow areas that slope to small drainageways. It is also on a few small oval-shaped knolls. Areas range from about 10 to 75 acres in size. Slopes are single in the long, narrow areas and convex on knolls. The average gradient is about 2 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Lewisville and Queeny soils. Lewisville soils are in about the same position as the Sunev soils, and Queeny soils are on shallow knolls and ridges. These spots are less than 2 acres in size.

Runoff is medium. The hazard of water erosion is moderate. The soil is suited to crops and improved pasture grasses, and it is suitable for grazing. Capability unit IIe–2; Clay Loam range site.

SuC3—Sunev loam, 3 to 5 percent slopes, eroded. This gently sloping soil is mainly in long, narrow areas where terraces break to the bottom lands. In a few areas it is on convex knolls or ridges. Areas range from about 10 to 50 acres in size. Slopes are single and have a gradient that averages about 4 percent. Most areas have a few gullies that are mainly 2 to 4 feet deep, 6 to 12 feet wide, and 200 to 600 feet apart. They make up about 10 to 20 percent of the mapped areas.

The surface layer is dark grayish-brown loam about 10 inches thick. The next layer is about 60 inches thick. The upper part is brown loam, and the lower part is very pale brown loam.

Included with this soil in mapping are a few spots of Lewisville and Queeny soils. These soils are in about the same position as Sunev soils. The spots are less than 2 acres in size.

Runoff is medium. The hazard of water erosion is moderate. The soil is mainly in abandoned, eroded cropland. A few areas are used for growing grazing crops. The soil is better suited to improved pasture grasses than to most other uses if gullies are shaped, smoothed, and filled. Capability unit IIIe–2; Clay Loam range site.

Trinity Series

The Trinity soils are deep, calcareous, nearly level, and clayey. They are on bottom lands. These soils formed in recent, calcareous, clayey alluvium.

In a representative profile the surface layer is dark-gray clay in the upper 22 inches. To a depth of 72 inches, it is dark-gray, very firm clay that has a few, thin, silty strata.

Trinity soils are somewhat poorly drained. Runoff, internal drainage, and permeability are very slow. Available water capacity is high. Frequency of flooding ranges from one or more times each year to about once every 7 to 10 years.

Representative profile of Trinity clay, frequently flooded, 14 miles north of Seguin on Texas Highway 123 to York Creek, then 300 feet into flood plain west of road:

A11—0 to 22 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, angular and subangular blocky structure; very hard, firm, very sticky and very plastic; few fine roots; surface mulch, about 0.5 inch thick, of hard, fine, discrete aggregates when dry; few shiny pressure faces on peds in lower part; calcareous, moderately alkaline; diffuse, wavy boundary.

A12—22 to 38 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; shiny pressure faces on peds; few nonintersecting slickensides; common filled cracks, mainly in upper part; few, thin, gray silty strata; calcareous, moderately alkaline; diffuse, wavy boundary.

A13—38 to 72 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, fine, angular blocky structure; very hard, very firm, very sticky and very plastic; few, thin, grayish-brown clayey strata; few nonintersecting slickensides; calcareous, moderately alkaline.

The A horizon is dark gray or very dark gray. It is 40 to 100 inches thick. Texture is clay between depths of 10 and 40 inches, and clay makes up 45 to 60 percent of the soil material. Thin grayish and brownish silty and clayey strata are present in most areas. When the soil is dry, cracks as wide as 1.5 inches at the surface extend to a depth of 2 to 4 feet. Reaction is mildly alkaline or moderately alkaline.

Tr—Trinity clay. This nearly level soil is mainly in the bends of creeks. Areas are mainly long and narrow and are about 1 to 2 feet higher than they are in

frequently flooded areas. They are subject to overflow for 1 to 2 days in spring or in fall about once every 7 to 10 years. The areas range from about 5 to 100 acres in size. Slopes have a gradient of less than 1 percent.

The soil, to a depth of 60 inches, is very dark gray, firm clay that has a few grayish-brown clay strata in the lower part. It is underlain, below a depth of 60 inches, by grayish-brown clay.

Included with this soil in mapping are a few slightly higher spots of Branyon soils that are not subject to flooding. Also included in places are a few spots of Seguin soils that are in about the same position as Trinity soils. These spots make up less than 15 percent of the mapped areas.

The soil is somewhat poorly drained. Most areas are used for growing crops and improved pasture grasses. It is well suited to these uses. Capability unit IIw–1; Clayey Bottomland range site.

Tw—Trinity clay, frequently flooded. This nearly level soil is in the lowest part of flood plains of creeks. Areas flood 1 to 2 days mainly in spring or in fall of each year. Areas are about 200 to 1,200 feet wide, and they follow the drainage patterns of the creeks. Stream channels make up about 10 percent of the mapped areas. Areas are mainly several hundred acres in size. Slopes have a gradient of less than 1 percent. The profile of this soil is the one described as representative of the series. In places limestone and chert pebbles are on the surface.

Included with this soil in mapping are a few spots of Bosque and Seguin soils that are in about the same position as Trinity soils. These spots make up less than 15 percent of the mapped areas.

The soil is somewhat poorly drained. It is suited to improved pasture grasses, native range, and recreation. It is not suited to cultivated crops because of frequent flooding. Large trees provide shade for cattle and recreation areas and protect wildlife along many of the creeks. Capability unit Vw–1; Clayey Bottomland range site.

Uhland Series

The Uhland series consists of deep, noncalcareous, nearly level loamy soils on bottom lands. These soils formed in alluvium.

In a representative profile the surface layer is dark grayish-brown clay loam about 7 inches thick. The underlying material, to a depth of 60 inches, is brown, friable fine sandy loam. This material contains thin layers of sandy clay loam and loamy fine sand, and it has a few grayish-brown and yellowish-brown mottles.

Uhland soils are somewhat poorly drained, and the water table is within 36 inches of the surface in spring. Runoff is slow, and permeability is moderately slow. Available water capacity is medium. Many areas flood for 1 to 2 days in the spring or fall of each year, and some flood for 1 to 2 days about every 5 years.

Representative profile of Uhland clay loam in an area of Uhland soils, frequently flooded, 5 miles southwest of Seguin on Farm Road 467, 1 mile southeast on paved road to Cottonwood Creek, then 200 feet east of road in flood plain of creek:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, blocky structure; very hard, firm; few fine roots; common fine pores; few, very thin, very pale brown, loamy fine sand strata; few, fine, iron-manganese concretions; few wormcasts; few snail shells on surface; mildly alkaline; abrupt, smooth boundary.

IIC—7 to 60 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; few, fine, faint, grayish-brown and yellowish-brown mottles; massive; slightly hard, friable; few fine roots; common fine pores; common grayish-brown sandy clay loam strata 0.5 to 1 inch thick; few pale-brown loamy fine sand strata about 1 inch thick; bedding planes associated with strata; few, fine, iron-manganese concretions; neutral.

Reaction ranges from slightly acid to mildly alkaline in Uhland soils. The A horizon ranges from 4 to 12 inches in thickness. It is dark brown, brown, dark grayish brown, or grayish brown and has brownish and grayish mottles. It is fine sandy loam, loam, or clay loam.

A few siliceous pebbles are present in some profiles. Between depths of 10 and 40 inches, the soil material averages less than 18 percent clay and more than 15 percent of the sand is coarser than very fine sand. An individual stratum in the IIC horizon is yellow, brown, light gray, very dark gray, or brownish yellow. The IIC horizon is mottled in shades of gray, brown, or yellow. Texture of an individual stratum ranges from loamy fine sand to sandy clay.

Uh—Uhland fine sandy loam, occasionally flooded. This nearly level soil is mainly along creeks. It is subject to overflow 1 to 2 days in spring or fall about every 5 years. The soil has a water table within 3 feet of the surface for short periods in spring and fall. Areas range from 5 to 40 acres in size. They are slightly undulating, and slopes have a gradient that averages about 0.5 percent.

The surface layer is dark-brown fine sandy loam about 10 inches thick. The underlying material, to a depth of 60 inches, is brown fine sandy loam.

Included with this soil in mapping are a few small, low ridges of sandy soil and a few low spots of clayey soil. These included soils make up less than 15 percent of the mapped areas.

The soil is used for growing such crops as peanuts, watermelons, and improved pasture grasses. It is better suited to improved pasture grasses than to most other uses. Capability unit IIw–2; Loamy Bottomland range site.

Uw—Uhland soils, frequently flooded. These nearly level soils are on the lowest parts of flood plains of small creeks. These areas flood for 1 to 2 days, mainly in the spring or fall of each year. The water table is within 3 feet of the surface in spring or fall. Areas are long and narrow and follow the drainage patterns of creeks. Stream channels make up about 10 percent of the mapped areas. This soil has the profile described as representative of the series. The upper 10 inches of the surface layer is quite variable because of continuous deposition and scouring. Texture of this layer ranges, in short distances, from clay loam to fine sandy loam or loamy fine sand.

Most mapped areas are about 67 percent Uhland soils, 18 percent a soil containing more clay than Uhland soils, 5 percent a soil containing more sand than Uhland soils, and 10 percent stream channels. The more clayey soil is mainly in old channels and sloughs, and the sandier soil is on low ridges.

These soils are suited to improved pasture, native range, pecan groves, and recreation areas. They are

not suited to cultivated crops because of frequent flooding. Large trees provide shade for cattle and protection and food for wildlife. Capability unit Vw–1; Loamy Bottomland range site.

Vernia Series

The Vernia series consists of deep, noncalcareous, gently sloping, very gravelly sandy soils on uplands. These soils formed in thick beds of sand and gravel deposited by ancient streams.

In a representative profile the surface layer is very gravelly loamy sand about 44 inches thick. The upper part is pale brown and is 60 percent gravel; the lower part is very pale brown and is 80 percent gravel. The next layer is very firm, very gravelly and gravelly sandy clay loam 28 inches thick. The upper 12 inches is light gray and has red mottles. It is 70 percent, by volume, chert pebbles. The next 10 inches is light gray and red and has mottles. It is 35 percent, by volume, chert pebbles. The lower 6 inches, also mottled, is very pale brown, brownish yellow, and yellowish red. It is 20 percent, by volume, gravel. The underlying material, at a depth of 72 inches, is reddish-yellow gravelly sandy loam that is mottled in shades of red, gray, and yellow.

Vernia soils are well drained. Runoff is very slow, and permeability is moderate. Available water capacity is very low. The hazard of water erosion is slight.

Representative profile of Vernia very gravelly loamy sand, 1 to 5 percent slopes, 9 miles east of Seguin on U.S. Highway 90 to Kingsbury, 4 miles northeast of Kingsbury on gravel road, then 400 feet southeast of small cemetery to gravel pit:

A1—0 to 14 inches, pale-brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) moist; single grained, loose; few fine roots; about 60 percent, by volume, siliceous pebbles that are ¼ inch to 3 inches in diameter; few 3- to 5-inch cobbles; neutral; gradual, smooth boundary.

A2—14 to 44 inches, very pale brown (10YR 7/3) very gravelly loamy sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots; about 80 percent, by volume, siliceous pebbles that are ¼ inch to 3 inches in diameter; thin coatings of very fine sand and silt on the upper and lower surfaces of pebbles; neutral; clear, smooth boundary.

B21t—44 to 56 inches, light-gray (10YR 7/1) very gravelly sandy clay loam, gray (10YR 6/1) moist; common, medium, prominent red mottles; weak, fine, subangular blocky structure; extremely hard, very firm, slightly sticky; about 70 percent, by volume, siliceous pebbles that are mainly less than 1 inch in diameter; few thin clay films on ped and pebble surfaces; few, fine, iron-manganese concretions; strongly acid; gradual, smooth boundary.

B22t—56 to 66 inches, prominently and coarsely mottled, light-gray (2.5Y 7/2) and red (2.5YR 5/8) gravelly sandy clay loam; weak, fine, subangular blocky structure; extremely hard, very firm, slightly sticky; about 35 percent, by volume, siliceous pebbles that are mainly less than 1 inch in diameter; few thin clay films on surface of peds and pebbles; few, fine, iron-manganese concretions; very strongly acid; gradual, smooth boundary.

B3—66 to 72 inches, prominently and coarsely mottled very pale brown (10YR 7/3), brownish-yellow (10YR 6/8), and yellowish-red (5YR 5/8) gravelly sandy clay loam; weak, medium, blocky structure; extremely hard, very firm, slightly sticky; about 20 percent, by volume, siliceous pebbles that are mainly less than 1 inch in diameter; few clay films on peds and pebbles; few, fine, iron-manganese concretions; very strongly acid; gradual, smooth boundary.

C—72 to 80 inches, reddish-yellow (7.5YR 6/6) gravelly sandy loam, strong brown (7.5YR 5/6) moist; common, medium, distinct, light-gray, red, and yellow mottles; massive; very hard, firm, nonsticky; about 40 percent, by volume, siliceous pebbles that are mainly less than 1 inch in diameter; few, fine, iron-manganese concretions; very strongly acid.

The solum ranges from 60 to 110 inches in thickness. The A horizon ranges from 40 to 80 inches in thickness. Reaction ranges from slightly acid to mildly alkaline. The A horizon is brown, pale brown, very pale brown, grayish brown, or light brownish gray. It is 60 to 85 percent, by volume, siliceous pebbles and cobbles.

The B horizon is mottled and is dominantly light gray, light brownish gray, pale brown, brown, yellowish red, or red; or it is mottled in shades of red, gray, yellow, and brown. The B horizon is gravelly or very gravelly sandy loam or sandy clay loam. The upper 20 inches is 18 to 32 percent clay and 35 to 80 percent pebbles and cobbles. Reaction is medium acid to very strongly acid. The C horizon is mottled, red, gray, and yellow gravelly sandy loam to very gravelly sandy loam or very gravelly sandy clay loam.

VrC—Vernia very gravelly loamy sand, 1 to 5 percent slopes. This gently sloping soil is on broad ridges. Areas mainly have a broad, irregular shape, and most are several hundred acres in size. Slopes are convex and have a gradient that averages about 2 percent.

Included with this soil in mapping are spots of Crockett, Quihi, and Darst soils. Crockett soils are in low areas. Quihi soils are on small knolls. Darst soils are on the more sloping parts of the ridges. These spots are generally less than 3 acres in size and make up less than 15 percent of the mapped areas.

This soil is better suited to native range, to recreation, and as a source of road-fill material than to most other uses. Cultivated crops and improved pasture grasses do not grow well in this soil. The large amount of gravel in the soil causes it to be droughty. Capability unit IVs–1; Very Gravelly range site.

Windthorst Series

The Windthorst series consists of deep, noncalcareous, gently sloping, loamy soils on uplands. These soils formed in interbedded sand and clay.

In a representative profile the surface layer is yellowish-brown fine sandy loam about 8 inches thick. The next layer is about 28 inches thick. It is red, very firm clay in the upper part; mottled, red and yellowish-brown, very firm clay in the next part; and mottled, red, yellowish-brown, and pale-brown sandy clay loam in the lower part. The underlying material, to a depth of 72 inches, is strong-brown, very firm sandy clay loam that contains interbedded layers of sand.

Windthorst soils are moderately well drained. Runoff is medium, internal drainage is slow, and permeability is moderately slow. Available water capacity is high. The hazard of water erosion is moderate to severe.

Representative profile of Windthorst fine sandy loam, 1 to 5 percent slopes, eroded, about 7 miles south of Seguin on Texas Highway 123, 2 miles east on paved county road to Zion Hill Church, then 50 feet into pasture south of road:

A1—0 to 8 inches, yellowish-brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak, fine, granular structure; hard, friable; many fine roots; slightly acid; abrupt, smooth boundary.

B21t—8 to 19 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; few, fine, prominent, yellowish-brown mottles in lower part; moderate, medium, blocky structure; extremely hard, very firm; few fine roots; few fine pores; thick, continuous clay films on ped faces; slightly acid; gradual, smooth boundary.

B22t—19 to 36 inches, prominently mottled, red (2.5YR 4/6) and yellowish-brown (10YR 5/8) clay; moderate, medium, blocky structure; extremely hard, very firm; few fine roots; few fine pores; thick, continuous clay films on ped faces, medium acid; gradual, smooth boundary.

B3—36 to 48 inches, prominently mottled, red (2.5YR 4/6), yellowish-brown (10YR 5/8), and pale-brown (10YR 6/3) sandy clay loam; weak, medium, blocky structure; extremely hard, very firm; few fine roots; few thin clay films on ped faces; medium acid; gradual, smooth boundary.

C—48 to 72 inches, strong-brown (7.5YR 5/6) sandy clay loam; few, fine, faint, light brownish-gray mottles; massive; extremely hard, very firm; few thin interbedded layers of sand; neutral.

The solum ranges from 36 to 60 inches in thickness. The A horizon ranges from 4 to 14 inches in thickness. The A1 horizon is brown or yellowish brown. A thin A2 horizon, mostly 1 unit in value higher than the A1 horizon, is present in places. Reaction ranges from medium acid to neutral.

The B2t horizon ranges from 10 to 34 inches in thickness. It is red or reddish brown and is mainly unmottled in the upper part but has mottles in shades of red, gray, brown, and yellow in the lower part. Mottles with chromas of 2 or less are not within 30 inches of the surface. The B2t horizon is clay or sandy clay.

The B3 horizon ranges from 6 to 18 inches in thickness. It is red, reddish yellow, pale brown, or yellowish red. Mottles in shades of red, gray, brown, or yellow are present in this horizon in places. The B3 horizon ranges from sandy clay loam to sandy clay. Reaction ranges from medium acid to mildly alkaline. A few, fine, calcium-carbonate concretions are below a depth of 30 inches in the B3 horizon.

The C horizon is mainly red, strong-brown, or yellow sandy clay loam interbedded with sand and clay. Reaction ranges from slightly acid to moderately alkaline (calcareous).

WdB—Windthorst fine sandy loam, 1 to 3 percent slopes. This gently sloping soil is mainly on ridgetops. Areas are irregularly shaped and range from about 10 to 80 acres in size. Slopes are convex and have a gradient that averages about 2 percent.

The surface layer is brown fine sandy loam about 10 inches thick. The next layer is about 50 inches thick. The upper part is reddish-brown, very firm clay; the middle part is mottled, red and reddish-yellow, very firm clay; and the lower part is mottled, reddish-yellow and yellowish-brown, very firm sandy clay loam. Interbedded sand and clay is below a depth of 60 inches.

Included with this soil in mapping are a few small low spots of Crockett, Demona, and Mabank soils. These spots are less than 3 acres in size and make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is moderate. Some areas of this soil are used for crops, and other areas are in improved pasture. The soil is suited to these uses. Capability unit IIe–3; Sandy Loam range site.

WdC3—Windthorst fine sandy loam, 1 to 5 percent slopes, eroded. This gently sloping soil is in irregularly shaped, convex areas that range in size from about 10 to 100 acres. Slopes are convex and have a gradient that averages about 3 percent. Water erosion has removed part of the surface layer in about 20 to 40 percent of most mapped areas. In other areas the surface layer ranges from about 4 to 8 inches in thickness. Gullies that are about 2 to 6 feet deep, 4 to 20 feet wide, and 200 to 500 feet apart make up about 25 to 30 percent of most mapped areas. This soil has the profile described as representative of the series.

Included with this soil in mapping are spots of Demona soils in a concave position below Windthorst soils and Crockett soils in about the same position as Windthorst soils. These spots are less than 3 acres in size and make up less than 15 percent of the mapped areas.

Runoff is medium. The hazard of water erosion is severe. The soil is mainly in abandoned, eroded cropland. Some areas are used for grazing crops and improved pasture grasses. The soil is better suited to improved pasture grasses than to most other uses, if gullies are shaped, smoothed, and filled. Capability unit IIIe–3; Sandy Loam range site.

Use of the Soils for Crops and Pasture

The soils in Guadalupe County are used mainly for crops and pasture. The type and intensity of management needed varies according to the kind of soil and kind of farming. Erosion control, drainage, conservation of soil moisture, and maintenance of fertility, organic matter, and soil structure and tilth are the main objectives of management. Predicted yields of the main crops are given in this section.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for engineering, or for other uses.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. (None in Guadalupe County.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States but not in Guadalupe County, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–2 or IIIe–5. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following paragraphs, the capability units in Guadalupe County are described and suggestions for the use and management of the soils are given.

CAPABILITY UNIT I–1

This unit consists of deep, well-drained, moderately permeable, nearly level silty clays and silty clay loams on stream terraces and bottom lands.

These soils are well suited to cultivated crops and improved pasture grasses. Cotton, corn, and grain sorghum are the principal crops. Suitable permanent pasture grasses include common bermudagrass and Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems. Johnsongrass, sudangrass, sorghum almum, and oat are suitable for supplemental pasture.

Available water capacity is high in these soils, and they are easily tilled and readily penetrated by plant roots, water, and air. Despite these favorable characteristics, however, there are a few management concerns. Compacted plow layers form if the soils are plowed to the same depth each year or if they are plowed when wet. The hazard of water erosion is slight. The moderate to high content of lime makes some nutrients unavailable, and some crops develop chlorosis. Cotton yields are reduced by cotton root rot at times.

A suitable cropping system includes grain sorghum or corn, which produce large amounts of residue. Returning crop residue to the soil helps to maintain organic-matter content, increase water intake, conserve moisture, and improve soil structure and tilth. In some areas diversion terraces and grassed waterways are needed to protect the soil from runoff from higher areas. Good pasture management requires rotational grazing, maintenance of proper height of forage plants during grazing periods, fertilization, weed and brush control, and an adequate supply to water for livestock. Crops and pasture grasses respond well to added fertilization, but fertilizers should be applied as recommended by soil test.

CAPABILITY UNIT IIe–1

This unit consists of deep, moderately well drained to well drained, very slowly permeable, gently sloping clays or gravelly clays on stream terraces and uplands.

These soils are well suited to cotton, corn, and grain sorghum. They are also suited to improved pasture grasses such as Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems. Johnsongrass, sudangrass, sorghum almum, and oats are suitable for supplemental pasture.

Available water capacity is high in these soils. The hazard of water erosion is moderate. The clay or gravelly clay surface layer is difficult to work. If plowed when wet, it becomes cloddy and a compacted plow layer forms. The soils have deep cracks when dry. Water enters the cracks rapidly until they close, and then permeability is very slow. Plant roots, water, and air move through the soil very slowly. Cotton yields are reduced in some areas by cotton root rot.

The cropping system should include grain sorghum or corn, which produce large amounts of residue. Returning crop residue to the soil helps to protect the soil from erosion, increase water intake, conserve moisture, and maintain organic-matter content and good soil tilth. Terraces and contour tillage help to protect the soil from erosion if row crops are planted. In some areas diversion terraces and grassed waterways are needed to help control erosion caused by runoff from

surrounding soils and to provide outlets for terraces. These soils respond well to fertilizers, but fertilizers should be applied for cultivated crops and pasture grasses as recommended by soil test. Good pasture management requires rotational grazing, maintenance of proper height of forage plants during grazing periods, fertilization, weed and brush control, and an adequate water supply for livestock.

CAPABILITY UNIT IIe–2

This unit consists of deep, well-drained, moderately permeable to slowly permeable, gently sloping silty clays to loams on terraces.

These soils are suited to cultivated crops and improved pasture grasses. Cotton, corn, and grain sorghum are the principal crops. Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems are suitable for improved pasture. Johnsongrass, sudangrass, sorghum almum, and oats are suitable for supplemental pastures.

Available water capacity is medium to high in these soils. The hazard of water erosion is moderate. The soils are easily tilled and readily penetrated by plant roots, water, and air. Compacted plow layers form if the soils are plowed when wet or plowed to the same depth each year. The high content of lime of some of the soils tends to make some nutrients unavailable for plant use, and crops develop chlorosis. Cotton root rot reduces cotton yields at times.

The cropping system should include grain sorghum or corn, which produce large amounts of residue. Returning crop residue to the soil helps to control erosion, conserve moisture, increase water intake, and maintain organic-matter content and good tilth. Terraces and contour tillage help to protect the soils from erosion. Diversion terraces and grassed waterways help to control erosion caused by runoff from surrounding soils and to provide outlets for terraces. These soils respond well to added fertilizer, but recommendations made by soil test should be followed when applying fertilizer to cultivated crops and pasture grasses. Good pasture management should include rotational grazing, maintenance of proper height of forage plants during grazing periods, fertilization, weed and brush control, and an adequate water supply for livestock.

CAPABILITY UNIT IIe–3

Windthorst fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. It is a deep, moderately well drained, moderately slowly permeable, gently sloping soil on uplands.

This soil is suited to peanuts, watermelons, and grain sorghum. Coastal bermudagrass and Kleingrass are suitable for improved pasture. Sudangrass, sorghum almum, and oats are suitable for supplemental pasture.

Available water capacity is high, but there are some management concerns. Movement of plant roots, water, and air is restricted. The hazard of water erosion is moderate.

The cropping system should include crops such as grain sorghum, which produces large amounts of residue. Returning crop residue to the soil helps to protect the soil from erosion, increase water intake, conserve moisture, and maintain organic-matter content and good tilth. Terraces and contour tillage help to protect the soil from erosion. Diversion terraces and grassed waterways help control runoff from higher areas and provide outlets for terraces. The soil responds well to added fertilizer, but the amount of fertilizer to be applied for crops and pasture grasses is best determined by soil test. Good pasture management requires rotational grazing, maintenance of proper height of forage plants during grazing periods, fertilization, weed and brush control, and an adequate water supply for livestock.

CAPABILITY UNIT IIw–1

This unit consists of deep, moderately well drained to somewhat poorly drained, very slowly permeable, nearly level clays to gravelly clays on uplands and bottom lands.

These soils are well suited to cotton, corn, and grain sorghum. They are also suited to common and Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems. Johnsongrass, sudangrass, sorghum almum, and oats grow well on the soils.

Available water capacity is high in these soils, but there are some management concerns. The soils are wet for short periods following heavy rain because runoff is slow and permeability is very slow in the lower layers. Plant roots, water, and air move through the soil very slowly. The clay or gravelly clay surface layer is difficult to work. If plowed when wet, it becomes cloddy and a compacted plow layer forms. In some areas cotton yields are reduced by cotton root rot.

Grain sorghum or other crops such as corn, which produce large amounts of residue, should be included in the cropping system. Returning crop residue to the soil helps to maintain organic-matter content, increase water intake, conserve moisture, and improve tilth. Runoff from surrounding areas can be controlled by diversion terraces and grassed waterways. These soils respond well to added fertilizers, but fertilizers should be applied for crops and pasture grasses as recommended by soil test. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock.

CAPABILITY UNIT IIw–2

Uhland fine sandy loam, occasionally flooded, is the only soil in this unit. It is a deep, somewhat poorly drained, moderately slowly permeable, nearly level soil on bottom lands.

This soil is suited to peanuts, watermelons, and improved pasture grasses such as common and Coastal bermudagrass and Kleingrass. Sudangrass, sorghum, almum, and oats are suitable for supplemental pasture.

This soil has a temporary water table within 36 inches of the surface in spring. Available water capacity is medium. The hazard of water erosion is slight.

Returning crop residue to the soil helps to conserve moisture and maintain organic-matter content and tilth. Diversion terraces and grassed waterways are needed in some areas to control runoff from surrounding soils. Good pasture management requires rotational grazing, maintenance of proper height of forage

plants during grazing periods, fertilization, weed and brush control, and an adequate water supply for livestock. The soil responds well to added fertilizers, but fertilizers should be applied as recommended by soil test.

CAPABILITY UNIT IIs–1

This unit consists of deep, well-drained, moderately permeable to slowly permeable, nearly level silty clays to loams on terraces.

These soils are well suited to cultivated crops and improved pasture grasses. Cotton, corn, and grain sorghum are the principal crops. Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems are suitable for permanent pasture. Johnsongrass, sudangrass, sorghum almum, and oats are suitable for supplemental pasture.

Available water capacity is medium to high in these soils. The soils are easily tilled and readily penetrated by plant roots, water, and air. Despite these characteristics there are some management concerns. Compacted plow layers form if the soils are plowed to the same depth each year or plowed when wet. The hazard of water erosion is slight. The content of high lime of some of the soils makes some nutrients unavailable for plant use, and crops develop chlorosis. Cotton yields are reduced by cotton root rot at times.

The cropping system should include grain sorghum or corn, which produce large amounts of residue. Returning crop residue to the soil helps to maintain organic-matter content, increase water intake, conserve moisture, and maintain tilth. Diversion terraces and grassed waterways are needed in some areas to protect the soil from runoff from surrounding areas. These soils respond well to added fertilizers, but fertilizers should be applied for crops and pasture grasses as recommended by soil test. Good pasture management requires rotational grazing, maintenance of proper height of forage plants during grazing periods, fertilization, weed and brush control, and an adequate supply of water for livestock.

CAPABILITY UNIT IIIe–1

This unit consists of deep, well drained to moderately well drained, very slowly permeable, gently sloping clays to gravelly clays on uplands.

These soils are suited to cotton, corn, and grain sorghum and to pasture grasses such as Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems. Johnsongrass, sudangrass, sorghum almum, and oats are suitable for supplemental pasture.

These soils need good management. The hazard of water erosion is slight to moderate. Available water capacity is high. The clay or gravelly clay surface layer is difficult to work. If the soils are plowed when wet, they become cloddy and a compacted plow layer forms. These soils have deep cracks when dry. Water enters the cracks rapidly until they close, and then permeability is very slow. Plant roots, water, and air move through the soil very slowly. Cotton yields are reduced by cotton root rot at times.

Grain sorghum or corn should be included in the cropping system to produce large amounts of residue. Terraces and contour tillage are needed to protect the soil from erosion. Returning crop residue to the soil helps to protect the soil from erosion, increase water intake, conserve moisture, and maintain organic-matter content and tilth. Grassed waterways and diversion terraces are needed in some places to control runoff from surrounding areas and provide outlets for terraces. The soils respond well to added fertilizers, but fertilizers, should be applied as recommended by soil test. Rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate water supply for livestock are needed for pasture. Some areas require shaping, smoothing, and filling of gullies before pasture grasses are planted or sprigged.

CAPABILITY UNIT IIIe–2

This unit consists of moderately deep to deep, well-drained, moderately to moderately slowly permeable, gently sloping silty clays to loams on terraces and uplands.

These soils are suited to cotton, corn, and grain sorghum. Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems are suitable for improved pasture. Johnsongrass, sudangrass, sorghum almum, and oats are suitable for supplemental pasture.

These soils need careful management. The hazard of water erosion is moderate. Available water capacity is medium to high. The movement of plant roots, water, and air through the soil is good. Compacted plow layers form if the soils are plowed to the same depth each year or if they are plowed when wet. The high content of lime makes some nutrients unavailable for plant use, and crops develop chlorosis. Cotton yields are reduced by cotton root rot at times.

The cropping system should include corn and grain sorghum, which produce large amounts of residue. Terraces and contour tillage are needed to protect the soil from water erosion. Returning crop residue to the soil helps to control erosion, increase water intake, conserve moisture, and maintain organic-matter content and tilth. In some areas, diversion terraces and grassed waterways are needed to control runoff from surrounding soils and to provide outlets for terraces. Crops and pasture grasses respond best to fertilizers applied as recommended by soil test. Some areas require shaping, smoothing, and filling of gullies before pasture grasses are planted or sprigged. Good pasture management requires rotational grazing, maintenance of proper height of forage plants during grazing periods, fertilization, weed and brush control, and an adequate supply of water for livestock.

CAPABILITY UNIT IIIe–3

This unit consists of deep, moderately well drained to somewhat poorly drained, moderately slowly to very slowly permeable, gently sloping fine sandy loams to loams on uplands.

These soils are suited to cotton, corn, grain sorghum, and peanuts. They are well suited to improved pasture grasses such as Coastal bermudagrass and Kleingrass. Sudangrass, sorghum almum, and oats are suitable for supplemental pasture.

These soils need good management. Available water capacity is medium to high. The hazard of water erosion is moderate, and some areas are eroded. The move-

ment of plant roots, water, and air through the dense clayey lower layers is slow to very slow.

The cropping system should include grain sorghum or corn, which produce large amounts of residue. Returning crop residue to the soil helps to control erosion, increase water intake, conserve moisture, and maintain organic-matter content and tilth. Terraces and contour tillage help to control water erosion. Diversion terraces and grassed waterways are needed in some areas to control runoff from surrounding soils and provide outlets for terraces. In eroded areas, gullies should be shaped, smoothed, and filled before planting or sprigging pasture grasses. These soils respond well to added fertilizers, but fertilizers should be applied as recommended by soil test. Rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock are needed for good pasture management.

CAPABILITY UNIT IIIe–4

Demona loamy fine sand, 1 to 5 percent slopes, is the only soil in this unit. It is a deep, moderately well drained, moderately slowly permeable, gently sloping soil on uplands.

This soil is suited to peanuts and watermelons. It is well suited to improved pasture grasses such as Coastal bermudagrass and Kleingrass. Sundangrass, sorghum almum, and oats are suitable for supplemental pasture.

This soil needs management that conserves moisture and protects the soil from erosion. Available water capacity is medium. The hazards of soil blowing and water erosion are moderate. Returning crop residue to the soil helps to protect it from erosion, conserve moisture, and maintain organic-matter content and tilth. Oats or other cover crops should be planted to protect the soil from blowing in fall, winter, and spring. The soil responds well to added fertilizers, but fertilizers should be applied to crop and pasture plants as recommended by soil test. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock.

CAPABILITY UNIT IIIe–5

Doss silty clay, 1 to 3 percent slopes, is the only soil in this unit. It is a shallow, well-drained, moderately slowly permeable, gently sloping soil on uplands.

This soil is not well suited to cultivated crops. It is better suited to improved pasture grasses and native range than to most other uses. Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems are suitable pasture grasses. Johnsongrass, sudangrass, sorghum almum, and oats are suitable for supplemental pastures.

This soil has low available water capacity. It is droughty because it is shallow. The hazard of water erosion is moderate. If cultivated crops are grown, terraces and contour tillage are needed to help protect the soil from erosion. Returning crop residue to the soil helps to protect the soil from erosion, conserve moisture, increase water intake, and maintain organic-matter content and tilth. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock. Soil test recommendations should be followed if fertilizing is applied to crops and pasture plants.

CAPABILITY UNIT IIIw–1

Mabank loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, somewhat poorly drained, very slowly permeable, nearly level soil on uplands.

This soil is suited to cotton, corn, grain sorghum, and in some areas peanuts. It is suited to improved pasture grasses such as Coastal bermudagrass, Kleingrass, and introduced bluestems. Sudangrass, sorghum almum, and oats are suitable for supplemental pastures.

This soil has medium available water capacity. It is wet for short periods following heavy rain because runoff is slow and permeability is very slow. Plant roots, water, and air move through the dense, clayey lower layers very slowly. The hazard of water erosion is slight.

The cropping system should include grain sorghum or corn, which produce large amounts of residue. Returning crop residue to the soil helps to maintain organic-matter content and tilth, increase water intake, and conserve moisture. In some areas diversion terraces and grassed waterways are needed to control runoff from surrounding areas. The soil responds well to fertilizers, but fertilizers should be applied as recommended by soil test. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock.

CAPABILITY UNIT IIIs–1

Crockett fine sandy loam, 0 to 1 percent slopes, is the only soil in this unit. It is a deep, moderately well drained, very slowly permeable, nearly level soil on uplands.

This soil is suited to cotton, corn, grain sorghum, and peanuts. It is also suited to improved pastures. Coastal burmudagrass, Kleingrass, and introduced bluestems are suitable grasses. Sudangrass, sorghum almum, and oats are suitable for supplemental pasture.

This soil has high available water capacity. Plant roots, water, and air move through the dense clayey layers very slowly. The hazard of water erosion is slight.

The cropping system should include corn or grain sorghum, which produce large amounts of residue. Returning crop residue to the soil helps to conserve moisture, increase water intake, and maintain organic matter and tilth. Diversion terraces and grassed waterways are needed in some areas to control runoff from surrounding soils. The soil responds well to added fertilizers, but fertilizers should be applied as recommended by soil test. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock.

CAPABILITY UNIT IVe–1

Austin silty clay, 3 to 5 percent slopes, eroded, is the only soil in this unit. It is a moderately deep, well-drained, moderately slowly permeable, gently sloping soil on uplands.

This soil is suited to cotton, corn, and grain sorghum. It is well suited to improved pasture grasses such as Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems. Johnsongrass, sudangrass, sorghum almum, and oats are suitable for supplemental pasture.

This soil requires careful management to protect it from erosion. Available water capacity is high. The movement of plant roots, water, and air through the soil is good. Compacted plow layers form if the soil is plowed when wet or to the same depth each year. The high content of lime makes some nutrients unavailable for plant use, and crops sometimes develop chlorosis. Cotton yields are reduced by cotton root rot at times.

Terraces and contour tillage are needed to protect the soil from erosion. Grain sorghum or corn, which produce large amounts of residue, should be included in the cropping system. Returning crop residue to the soil helps to protect the soil from erosion, increase water intake, conserve moisture, and maintain organic-matter content and tilth. In some areas diversion terraces and grassed waterways are needed to control runoff from surrounding areas and provide outlets for terraces. The soil responds well to added fertilizer, but fertilizers should be applied as recommended by soil test. Some areas require shaping, smoothing, and filling of gullies before pasture grasses are planted or sprigged. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock.

CAPABILITY UNIT IVe–2

This unit consists of deep, moderately well drained to somewhat poorly drained, very slowly permeable, gently sloping loams or gravelly sandy loams on uplands.

These soils are not well suited to cultivated crops. Cotton, corn, grain sorghum, and peanuts are grown in a few areas. The soils are better suited to improved pasture grasses such as Coastal bermudagrass, Kleingrass, and introduced bluestems than to most other uses. Sudangrass, sorghum almum, and oats are suitable for supplemental pasture

These soils require careful management. Available water capacity is medium to high. The hazard of water erosion is moderate to severe. Brush infestation is a concern in some areas. Plant roots, water, and air move through the lower layers very slowly.

Terraces and contour tillage are needed to protect the soils from erosion. Grain sorghum or corn, which provide large amounts of residue, should be included in the cropping system. Returning crop residue to the soil helps to control erosion, increase water intake, conserve moisture, and maintain organic-matter content and tilth. In some areas diversion terraces and grassed waterways are needed to control runoff from surrounding soils and to provide outlets for terraces. Some areas require brush clearing and shaping, smoothing, and filling of gullies before pasture grasses are planted or sprigged. The soils respond well to added fertilizers, but fertilizers should be applied as recommended by soil test. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock.

CAPABILITY UNIT IVe–3

Heiden clay, 5 to 8 percent slopes, eroded, is the only soil in this unit. It is a deep, well-drained, very slowly permeable, sloping soil on uplands.

This soil is not well suited to crops, but cotton, corn, and grain sorghum are grown in a few areas. It is better suited to improved pasture grasses such as Kleingrass, Coastal bermudagrass, and introduced varieties of bluestems than to most other uses. Johnsongrass, sudangrass, sorghum almum, and oats are suitable for supplemental pastures.

This soil has high available water capacity. The hazard of water erosion is severe. The clay surface layer is difficult to work. It becomes cloddy and a compacted plow layer forms if the soil is plowed when wet. The soil has deep cracks when dry. Water enters the cracks rapidly until they close, and then permeability is very slow. Plant roots, water, and air move through the soil very slowly.

Terraces and contour farming help to control erosion in areas used for crops. Grain sorghum or corn, which produce large amounts of residue, should be included in the cropping system. Returning crop residue to the soil helps to increase water intake, conserve moisture, and maintain organic-matter content and tilth. The residue should be left on or near the surface. Diversion terraces and grassed waterways are needed in some areas to control runoff from surrounding areas and to provide outlets for terraces. The soil responds well to added fertilizers, but fertilizers should be applied as recommended by soil test. In some areas gullies should be shaped, smoothed, and filled before pasture grasses are planted or sprigged. Rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock are needed for pasture.

CAPABILITY UNIT IVs–1

This unit consists of deep, moderately well drained to well drained, moderately slowly to very rapidly permeable, gently sloping to sloping fine sands to very gravelly loamy sands on uplands.

These soils are suited to peanuts and watermelons if fertilized. They are also suited to improved pasture grasses such as Coastal bermudagrass or Kleingrass. Sudangrass, sorghum almum, and oats are suitable for supplemental pastures.

These soils require management that conserves moisture and maintains organic-matter content and fertility. Available water capacity is low or very low. The hazards of soil blowing and water erosion are slight.

Returning crop residue to the soil helps to control soil blowing, conserve moisture, and maintain organic-matter content and tilth. Oats protect the soils from

blowing in fall, winter, and spring. These soils respond to small, frequent applications of fertilizers, but fertilizers should be applied as recommended by soil test. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock.

CAPABILITY UNIT IVs–2

This unit consists of very shallow to moderately deep, well-drained, moderately slowly to slowly permeable in the petrocalcic horizon, gently sloping gravelly loams on terraces and uplands.

Most of these soils are used as a source for gravel for road construction. They are poorly suited to cultivated crops. They are suited to improved pasture grasses such as Coastal bermudagrass, Kleingrass, and introduced varieties of bluestems. Some areas are suited to oats for supplemental pastures.

These soils have low to very low available water capacity. Returning crop residue to the soil helps to conserve moisture and maintain organic-matter content and tilth. Pastures require rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock. Some of the smaller gravel pits can be converted to ponds and stocked with fish. Some larger pits can be seeded to grass or other suitable vegetation and used for wildlife habitat.

CAPABILITY UNIT Vw–1

This unit consists of deep, well-drained to somewhat poorly drained, moderately permeable to very slowly permeable, nearly level, frequently flooded loams to clays on bottom land.

These soils are not suited to cultivated crops because they are frequently flooded. They are suited to pasture grasses such as common and Coastal bermudagrass and medio bluestem. In some areas the soil is well suited to pecans.

These soils receive runoff from surrounding areas. Available water capacity is medium to high.

These soils respond to fertilizers, but fertilizers should be applied for pasture grasses and pecan trees as recommended by soil test. Good pasture management requires rotational grazing, maintenance of proper height of forage plants during grazing periods, fertilization, weed and brush control, and an adequate supply of water for livestock. Good pecan management requires fertilization and insect and disease control.

CAPABILITY UNIT VIe–1

This unit consists of deep, moderately well drained to well drained, moderately permeable to very slowly permeable, gently sloping to moderately steep clays to loams on uplands and terraces.

These soils are not suited to cultivated crops. Suitable pasture grasses include Coastal bermudagrass, King Ranch bluestem, and Kleingrass.

These soils have a severe hazard of water erosion. Erosion has removed the original surface layer from many places and exposed the underlying material. Available water capacity is high.

The main need of these soils is the control of erosion by establishing a plant cover. Many areas require shaping, smoothing, and filling of gullies before pasture grasses can be seeded or sprigged. Diversion terraces are needed in some areas to control runoff from surrounding soils. These soils should be fertilized as recommended by soil test to establish pasture grasses. Grazing must be controlled after grasses have been established to prevent future erosion. Good pasture management requires rotational grazing, weed and brush control, maintenance of proper height of forage plants during grazing periods, fertilization, and an adequate supply of water for livestock.

CAPABILITY UNIT VIe–2

Darst very gravelly sandy loam, 5 to 10 percent slopes, is the only soil in this unit. It is a moderately sloping to strongly sloping soil on uplands.

This soil is not suited to crops. It is suited to native range and to pastures of Coastal bermudagrass and weeping lovegrass.

This soil has medium available water capacity. The hazard of water erosion is severe.

A good vegetative cover should be kept on the soil to help control erosion. The high content of gravel sometimes makes it difficult to get pasture grasses established. Grazing must be controlled on pasture and range to maintain a good vegetation cover. Pasture grasses should be fertilized as recommended by soil test. Good pasture and range management requires rotational grazing, maintenance of proper height of forage plants during grazing periods, weed and brush control, and an adequate supply of water for livestock.

CAPABILITY UNIT VIe–3

Eddy gravelly clay loam, 3 to 5 percent slopes, is the only soil in this unit. It is a very shallow, well-drained, moderately slowly permeable, gently sloping soil on uplands.

This soil is not suited to cultivated crops and is poorly suited to pasture grasses such as Coastal bermudagrass, King Ranch bluestem, and Kleberg bluestem. It is better suited to native range than to most other uses.

The soil has very low available water capacity. The hazard of water erosion is moderate.

The main need of the soil is the establishment of a vegetative cover to prevent erosion. Grazing should be controlled on pasture and range to maintain a vegetative cover. Pasture grass fertilization should be according to soil test. Good pasture and range management requires rotational grazing, maintenance of proper height of forage plants during grazing periods, and brush control, and an adequate supply of water for livestock.

CAPABILITY UNIT VIs–1

Queeny gravelly loam, 5 to 20 percent slopes, is the only soil in this unit. It is a very shallow to shallow, well-drained, slowly permeable in the petrocalcic horizon, sloping to moderately steep soil on terraces.

This soil is used mainly as a source of gravel for road construction. It is poorly suited to Coastal bermudagrass, Kleingrass, and King Ranch bluestem.

This soil has a very low available water capacity. The hazard of water erosion is moderate.

A good vegetative cover should be maintained to help prevent erosion, and grazing should be controlled on pasture and range to maintain a good cover. Pasture grass grows best when fertilized according to soil test. Good pasture and range management requires weed and brush control and an adequate supply of water for livestock. Gravel pits are in many areas, and some can be reclaimed and used for wildlife habitat and recreational areas.

CAPABILITY UNIT VIIs-1

Only soils of the Nebgen-Jedd complex, 3 to 20 percent slopes, are in this unit. These soils are very shallow to moderately deep, well-drained, moderately slow to moderately rapidly permeable, gently sloping to moderately steep cobbly sandy loams. They are on uplands.

These soils are better suited to native range and wildlife habitat than to most other uses. They are not suited to cultivated crops or improved pasture grasses.

These soils are droughty. Available water capacity is low or very low. The hazard of water erosion is slight to moderate. A good vegetative cover should be maintained to help protect the soil from erosion. Good range management requires controlled grazing, brush control, and an adequate supply of water for livestock.

Predicted Yields

Table 2 lists predicted yields of the principal crops grown in the county. The predictions are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the county and on information taken from research data. The predicted yields are average yields per acre that can be expected by good commercial farmers at the level of management which tends to produce the highest economic returns. The yields are given for dryland farming.

Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included because their acreage is small or reliable data on yields are not available.

The predicted yields given in table 2 can be expected if rainfall is effectively used and conserved; surface and subsurface drainage systems, or both, are installed; crop residues are managed to maintain tilth; minimum but timely tillage is used; insect, disease, and weed control measures are consistently used; fertilizer is applied according to soil test and crop needs; adapted crop varieties are used at recommended seeding rates.

Use of the Soils for Range[2]

Native range covers about 37 percent of Guadalupe County. The largest area of range is in the sand hills in the southern part of the county, and only small, scattered areas are in other parts of the county. The range is used mainly for livestock grazing, as wildlife habitat, and for recreation. Much of the range has been overgrazed and brush infestation is a concern.

[2] By RUDY J. PEDERSON, range conservationist, Soil Conservation service.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

Range sites are kinds of range that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community. It reproduces itself and does not change as long as the environment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is less than 25.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good range management is to keep rangeland in excellent or good condition. If this is done, water is conserved, yields are improved, and the soils are protected. Recognizing important changes in the kind of cover on a range site is a concern. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy

TABLE 2.—*Predicted yields per acre of principal crops*

[Absence of yield indicates that the crop is not suited to or is not commonly grown on the soil]

Soil	Cotton (Lint)	Corn	Grain sorghum	Watermelons	Peanuts
	Lb	*Bu*	*Lb*	*Lb*	*Lb*
Altoga silty clay, 3 to 5 percent slopes, eroded	200	25	2,500		
Altoga silty clay, 5 to 12 percent slopes, eroded					
Arenosa fine sand, 1 to 8 percent slopes				3,500	900
Austin silty clay, 1 to 3 percent slopes	250	25	3,000		
Austin silty clay, 3 to 5 percent slopes, eroded	200	20	2,000		
Barbarosa silty clay, 0 to 1 percent slopes	350	50	4,500		
Barbarosa silty clay, 1 to 3 percent slopes	300	45	3,750		
Bosque and Seguin soils, frequently flooded					
Branyon clay, 0 to 1 percent slopes	450	60	5,000		
Branyon clay, 1 to 3 percent slopes	450	55	4,500		
Burleson clay, 0 to 1 percent slopes	450	55	4,500		
Burleson gravelly clay, 0 to 1 percent slopes	450	55	4,500		
Burleson gravelly clay, 1 to 3 percent slopes	400	50	4,000		
Crockett fine sandy loam, 0 to 1 percent slopes	375	40	3,000		750
Crockett fine sandy loam, 1 to 3 percent slopes	325	35	2,750		725
Crockett gravelly sandy loam, 1 to 5 percent slopes		25	2,250		
Crockett loam, 2 to 5 percent slopes, eroded		25	2,500		
Crockett loam, 3 to 8 percent slopes, severely eroded					
Darst very gravelly sandy loam, 5 to 10 percent slopes					
Demona loamy fine sand, 1 to 5 percent slopes		15	1,750	5,000	1,200
Doss silty clay, 1 to 3 percent slopes	225	25	2,000		
Eddy gravelly clay loam, 3 to 5 percent slopes					
Ferris and Heiden soils, 5 to 20 percent slopes, eroded					
Heiden clay, 1 to 3 percent slopes	400	55	4,250		
Heiden clay, 3 to 5 percent slopes	350	45	3,500		
Heiden clay, 3 to 5 percent slopes, eroded	300	40	3,000		
Heiden clay, 5 to 8 percent slopes, eroded	250	25	2,000		
Houston Black clay, 0 to 1 percent slopes	450	60	5,000		
Houston Black clay, 1 to 3 percent slopes	400	55	4,500		
Houston Black gravelly clay, 1 to 3 percent slopes	400	55	4,500		
Houston Black gravelly clay, 3 to 5 percent slopes	350	45	3,500		
Lewisville silty clay, 0 to 1 percent slopes	300	50	4,000		
Lewisville silty clay, 1 to 3 percent slopes	275	45	3,750		
Mabank loam, 0 to 1 percent slopes	350	35	3,250		750
Mabank loam, 1 to 3 percent slopes	300	30	2,750		725
Mabank loam, 1 to 3 percent slopes, eroded		25	2,250		
Nebgen-Jedd complex, 3 to 20 percent slopes					
Patilo and Arenosa soils, 1 to 8 percent slopes				4,000	900
Queeny gravelly loam, 1 to 5 percent slopes			1,250		
Queeny gravelly loam, 5 to 20 percent slopes					
Quihi soils, 1 to 5 percent slopes			1,500		
Seguin silty clay loam	350	50	4,500		
Sunev loam, 0 to 1 percent slopes	300	40	3,500		
Sunev loam, 1 to 3 percent slopes	280	35	3,250		
Sunev loam, 3 to 5 percent slopes, eroded	200	30	2,500		
Trinity clay	450	60	5,000		
Trinity clay, frequently flooded					
Uhland fine sandy loam, occasionally flooded		35	2,750	4,000	675
Uhland soils, frequently flooded					
Vernia very gravelly loamy sand, 1 to 5 percent slopes			1,250		
Windthorst fine sandy loam, 1 to 3 percent slopes			2,750	4,000	1,200
Windthorst fine sandy loam, 1 to 5 percent slopes, eroded			2,500	3,500	800

and the long-term trend is toward lower production. On the other hand, some range that has been closely grazed for short periods under the supervision of a careful manager can have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of Range Sites

In the following paragraphs the range sites of Guadalupe County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this soil survey.

BLACKLAND RANGE SITE

This site consists of deep, moderately well drained to well drained, very slowly permeable, nearly level to sloping clays to gravelly clays on uplands and terraces. Available water capacity is high. The hazard of water erosion is slight to severe.

The natural potential plant community is tall and

medium grasses. Little bluestem is dominant in the plant community, and indiangrass and big bluestem are subdominant. Numerous other grasses are in the potential plant community in fewer places or in smaller amounts. Many palatable forbs and legumes are native to the site. The approximate composition, by weight, of the climax plant community is little bluestem, 50 percent; indiangrass, 20 percent; Texas wintergrass, 5 percent; vine-mesquite, 5 percent; other grasses, 15 percent; perennial forbs and a few woody plants, 5 percent.

The site produces approximately 4,000 pounds of air-dry herbage per acre in unfavorable years and 8,000 pounds in favorable years. Approximately 95 percent of this is forage for livestock.

Under continued heavy grazing, little bluestem, indiangrass, big bluestem, switchgrass, Maximillian sunflower, and englemanndaisy decrease in the plant community. Such plants as silver bluestem, Texas wintergrass, tall dropseed, side-oats grama, and less palatable forbs increase. If overgrazing is prolonged, buffalograss and annual forbs and grasses may eventually dominate the site and greatly reduce total production.

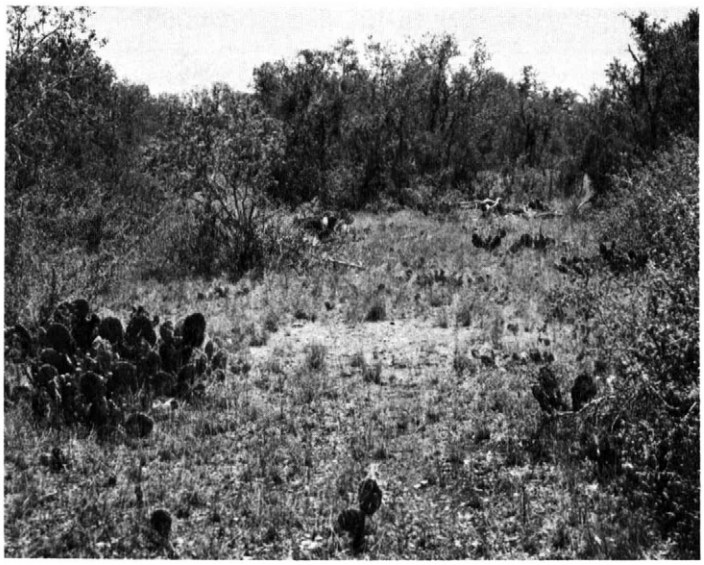


Figure 20.—**Chalky Ridge range site, in an area of Eddy gravelly clay loam, 3 to 5 percent slopes, showing thin stands of grass.**

CHALKY RIDGE RANGE SITE

This site consists of very shallow to moderately deep, well-drained, moderately slowly permeable to slowly permeable in the petrocalcic horizon, gently sloping to moderately steep silty clays, gravelly clay loams, or gravelly loams. These soils are on uplands and terraces. Available water capacity is low or very low. The hazard of water erosion is slight to severe. Soils in the Doss and Quihi series were included in this site because they occur only in a few small, scattered areas in close association with other soils in the site.

The natural potential plant community is mixed tall and mid grasses and scattered live oak. The approximate composition, by weight, of the climax plant community is little bluestem, 50 percent; indiangrass, 15 percent; side-oats grama, 15 percent; fall witchgrass, 5 percent; other grasses, 5 percent; perennial forbs, 5 percent; and live oaks, 5 percent.

This site produces approximately 2,000 pounds of air-dry herbage per acre in unfavorable years and about 3,500 pounds in favorable years (fig. 20). Approximately 90 percent of the production is forage for livestock.

Under continued heavy grazing, little bluestem and indiangrass decrease in the plant community. Texas wintergrass, side-oats grama, and silver bluestem increase. If overgrazing is prolonged, annual weeds, pricklypear, and three-awn grass make up a substantial part of the annual production and reduce total production.

CLAY LOAM RANGE SITE

This site consists of moderately deep to deep, well-drained, moderately to slowly permeable, nearly level to strongly sloping silty clays to loams on uplands and terraces. Available water capacity is medium to high. The hazard of erosion is slight to severe.

The natural potential plant community is true prairie grasses with a few live oak, elm, hackberry, and pecan trees scattered throughout the site. Also, many forbs, including perennial legumes, occur with tall and mid grasses. The approximate composition, by weight, of the climax plant community is little bluestem, 45 percent; indiangrass, 25 percent; Virginia wildrye and Texas wintergrass, 5 percent; vine-mesquite and side-oats grama, 5 percent; other grasses, 10 percent; perennial forbs, 5 percent; and trees, 5 percent.

The site produces approximately 3,500 pounds of air-dry herbage per acre in unfavorable years and about 7,000 pounds in favorable years. Approximately 90 percent of the production is forage for livestock.

Under continued heavy grazing the tall grasses decrease and such plants as silver bluestem, Texas wintergrass, and less palatable forbs, increase. If overgrazing is prolonged, buffalograss, annual forbs, and grasses invade the site.

CLAYEY BOTTOMLAND RANGE SITE

This site consists of deep, somewhat poorly drained, very slowly permeable, nearly level soils on bottom lands. Available water capacity is high. The soils receive runoff from surrounding areas. The hazard of erosion is slight.

The climax plant community is a mixture of grasses, forbs, shrubs, and trees such as elm and hackberry. The approximate composition, by weight, of the potential plant community is little bluestem, 30 percent; switchgrass, 15 percent; indiangrass, 15 percent; vine-mesquite, 5 percent; Virginia wildrye, 20 percent; and annual forbs 5 percent; and trees and shrubs, 10 percent. The climax plant community varies because of differences in position of the soil and frequency of overflow.

The site produces approximately 4,000 pounds of air-dry herbage per acre in unfavorable years and about 7,000 pounds in favorable years. Approximately 80 percent of the production is forage for cattle.

Under continued heavy grazing, switchgrass and

indiangrass decrease in the plant community. Grasses such as vine-mesquite and meadow dropseed increase. If overgrazing is prolonged, buffalograss and annual grasses and weeds increase.

CLAYPAN PRAIRIE RANGE SITE

This site consists of deep, moderately well drained to somewhat poorly drained, very slowly permeable, nearly level to sloping fine sandy loams, gravelly sandy loams, or loams on uplands. Available water capacity is medium to high. The hazard of water erosion is slight to severe.

The natural potential plant community is grasses and a few motts of post oak trees. The approximate composition, by weight, of the climax plant community is little bluestem, 15 percent; fourflower trickloris, 15 percent; cottontop and silver bluestem, 20 percent; buffalograss and mesquitegrass, 10 percent; plains bristlegrass, 5 percent; plains lovegrass and fringeleaf paspalum, 15 percent; Texas wintergrass and Virginia wildrye, 10 percent; forbs such as bush sunflower, primrose, and legumes, 5 percent; and shrubs and trees, 5 percent.

The site produces approximately 3,000 pounds of air-dry herbage per acre in unfavorable years and about 5,000 pounds in favorable years. Approximately 90 percent of this is forage for cattle

Plants that commonly invade the site are mesquite, huisache, whitebrush, spiny hackberry, pricklypear, and annual grasses and weeds. Buffalograss and curly mesquitegrass increase when the site is overgrazed. The brushy plants can be managed by mechanical and chemical means.

DEEP SAND SAVANNAH RANGE SITE

This site consists of deep, well drained to moderately well drained, moderately slowly permeable to very rapidly permeable, gently sloping fine sands on uplands. Available water capacity is low. The hazard of erosion is slight.

The site produces a savannah climax plant community of oak, hickory, and tall grasses as well as some shrubs and forbs. The approximate composition, by weight, of the climax plant community is post oak, blackjack oak, hickory, beautyberry, greenbriar, and other shrubs, 15 percent; little bluestem, 50 percent; indiangrass, 10 percent; sand lovegrass, beaked panicum, crinkleawn, switchgrass, brownseed paspalum, and purpletop, 10 percent; fringeleaf paspalum, mourning lovegrass, fall switchgrass, and others, 10 percent; and forbs such as tickclover, snoutbean, tephrosia, and annuals 5 percent.

The site produces approximately 1,000 pounds of air-dry herbage per acre in unfavorable years and 3,000 pounds in favorable years. Approximately 90 percent of this is forage for cattle.

Under continued heavy grazing, little bluestem (fig. 21), indiangrass, switchgrass, and sand lovegrass decrease in the plant community. Oak and annual forbs increase, and such plants as yankeeweed, smutgrass, pricklypear, cactus, and low brush become abundant if continuous heavy grazing is prolonged.

The site is hazardous to reseed because of soil blowing and rapid drying of the surface layer. The woody plant cover can be managed by mechanical and chemical means.

ERODED BLACKLAND RANGE SITE

This site consists of deep, well-drained, very slowly permeable, sloping to moderately steep clays on uplands. Available water capacity is high. The hazard of water erosion is severe.

The natural potential plant community is grasses that vary because of soil blowing. The approximate composition, by weight, of the climax plant community is little bluestem, 40 percent; indiangrass, 15 percent; vine-mesquite, 10 percent; silver bluestem, 10 percent; buffalograss, 5 percent; Texas wintergrass, 10 percent; other grasses, 5 percent; and perennial forbs including legumes, 5 percent.

The site produces approximately 2,500 pounds of air-dry herbage per acre in unfavorable years and 6,000 pounds in favorable years. Approximately 90 percent of this is forage for cattle.

Plants that commonly invade this site are three-awn grasses, broomweeds, baccharis, and mesquite. If grazing is heavy, buffalograss dominates in some areas.

LOAMY BOTTOMLAND RANGE SITE

This site consists of deep, moderately well drained to somewhat poorly drained, moderately permeable to moderately slowly permeable, nearly level loams, silty clay loams, and clay loams on bottom lands. Available water capacity is medium to high. The soils receive runoff from surrounding areas. The hazard of erosion is slight.

The natural potential plant community is a mixture of trees, shrubs, grasses, and forbs. The approximate composition, by weight, of the climax plant community is little bluestem, 35 percent; indiangrass, switchgrass, and southwestern bristlegrass, 20 percent; Texas wintergrass and Virginia wildrye, 10 percent; side-oats grama, plains bristlegrass, vine-mesquite, and others, 15 percent; pecans, elms, live oaks, hackberries, and woody vines and shrubs, 15 percent; and forbs such as spiderlilly, hairy ruellia, snoutbean, and others, 5 percent.

The site produces approximately 3,500 pounds of air-dry herbage per acre in unfavorable years and 6,500 pounds in favorable years. Approximately 90 percent of this is forage for livestock.

Under continued heavy grazing, bluestem and switchgrass decrease, and Texas wintergrass, trees, woody plants, and forbs increase.

The site provides good habitat for wildlife and is valuable for recreation. The woody plants can be controlled and managed by mechanical means.

SANDY RANGE SITE

This site consists of deep, moderately well drained, moderately slowly permeable, gently sloping loamy fine sands on uplands. Available water capacity is medium. The hazards of soil blowing and water erosion are moderate.

The natural potential plant community is grasses and scattered oaks. The approximate composition, by weight, is little bluestem, crinkleawn, and indiangrass, 50 percent; brownseed paspalum, 10 percent; side-oats grama, cottontop, pinhole, and silver bluestem, 10 per-

Figure 21.—**Little bluestem in an area of Patilo and Arenosa soils, 1 to 8 percent slopes, in Deep Savannah range site.**

cent; knotroot panicum, plains bristlegrass, and fall witchgrass, 10 percent; fringeleaf paspalum and hooded windmillgrass, 10 percent; forbs such as bush sunflower, orange zexminia, snoutbean, western indigo and gayfeather, 5 percent; and woody plants such as live oak, post oak, and hackberry, 5 percent.

The site produces approximately 2,000 pounds of air-dry herbage per acre in unfavorable years and 4,000 pounds in favorable years. Approximately 80 percent of this is forage for livestock.

Under continued heavy grazing, bluestem, indiangrass, and crinkleawn decrease. Fringeleaf paspalum and hooded windmill increase, and annual forbs become abundant. Mesquite and pricklypear commonly invade the site.

SANDSTONE HILLS RANGE SITE

This site consists of very shallow to moderately deep, well-drained, moderately slowly permeable to moderately rapidly permeable, gently sloping to moderately steep cobbly sandy loams on uplands. Available water capacity is low or very low. The hazard of water erosion is moderate.

The natural potential plant community is a savannah of post oak and blackjack oak trees and grasses and forbs. The approximate composition, by weight, is little bluestem, 45 percent; indiangrass, purpletop, and sand lovegrass, 15 percent; silver bluestem, 10 percent; fringeleaf paspalum, three-awn, and windmillgrass, 10 percent; post oak, blackjack, and catclaw acacia, 15 percent; and sensitivebriar, snoutbean, aster, knotweed, leaf-flower, and annuals, 5 percent.

The site produces approximately 2,000 pounds of air-dry herbage per acre in unfavorable years and 3,500 pounds in favorable years. Approximately 80 percent of this is forage for livestock.

Under heavy grazing, bluestem, indiangrass, and sand lovegrass decrease. Three-awn, red lovegrass, gummy lovegrass, and annual forbs increase and dominate the site.

SANDY LOAM RANGE SITE

This site consists of moderately deep to deep, well drained to moderately well drained, moderately slowly permeable, gently sloping to strongly sloping very gravelly sandy loams to fine sandy loams on uplands. Available water capacity is medium to high. The hazard of water erosion is moderate to severe.

The approximate composition, by weight, of the climax plant community is little bluestem or fourflower trichloris, 40 percent; Arizona cottontop and silver or pinhole bluestem, 20 percent; side-oats grama and plains bristlegrass, 10 percent; hooded windmill, fringeleaf paspalum, plains lovegrass, and others, 20

percent; post oak and live oak, 5 percent; and forbs such as western indigo, bundleflower, and zexmenia, 5 percent.

The site produces approximately 2,000 pounds of air-dry herbage per acre in unfavorable years and 3,500 pounds in favorable years. Approximately 80 percent of this is forage for livestock.

Under continued heavy grazing, bluestem grass decreases, and plants such as hooded windmill grass and annuals increase. Mesquite, huisache, and whitebrush are woody plants that invade. These woody plants can be managed by mechanical and chemical means.

VERY GRAVELLY RANGE SITE

This site consists of deep, well-drained, moderately permeable, gently sloping very gravelly loamy sands on uplands. Available water capacity is very low. The hazard of erosion is slight.

The natural potential plant community is an open stand of post oaks and a mixture of mid and tall grasses and forbs. The approximate composition, by weight, of the climax plant community is little bluestem, 40 percent; brownseed paspalum and beaked panicum, 20 percent; tall dropseed, 10 percent; low panicums, 5 percent; switchgrass, 5 percent; post oak, 10 percent; shrubs, 5 percent; and perennial legumes and forbs, 5 percent.

The site produces approximately 2,500 pounds of air-dry herbage per acre in unfavorable years and 3,500 pounds in favorable years. Approximately 70 percent of this is forage for livestock.

Under continued heavy grazing, little bluestem, switchgrass, and tall dropseed decrease in the plant community. Such plants as purple lovegrass, brownseed paspalum, low panicum, and oak increase. If overgrazing is prolonged, annual weeds and grasses make up a substantial part of the annual production and greatly reduce total production.

Use of the Soils for Wildlife Habitat

The principal kinds of wildlife in Guadalupe County are whitetail deer, fox squirrel, bobwhite quail, cottontail rabbit, jackrabbit, and numerous kinds of birds. Furbearing animals include raccoon, fox, ringtail cat, skunk, and opossum. Predators commonly found are bobcat and coyote. Small lakes, ponds, pits, creeks, and grain fields attract duck and geese during migration. Many farm and ranch ponds are stocked with channel catfish, black bass, and sunfish. The Guadalupe River and the San Marcos River provide very good fishing (fig. 22).

The fish and wildlife resources are of great economic importance in Guadalupe County. Successful management of wildlife requires, among other things, that food, cover, and water be available in a suitable combination. Most wildlife habitats are managed by planting suitable vegetation or by manipulating existing vegetation to increase or improve establishment of desired plants. Information about soils is helpful in creating, improving, or maintaining suitable food, cover, and water for wildlife.

Soil properties that affect the growth of wildlife habitat are: thickness of soil useful to crops, texture of surface layer, available water capacity to a depth of 40 inches, wetness, surface stoniness or rockiness, flood hazard, slope, and permeability.

In table 3 soils of Guadalupe County are rated for producing seven elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements.

A rating of good means the element of wildlife habitat and habitats generally are easily created, improved, and maintained. Few or no limitations affect management in this category and satisfactory results are expected if the soil is used for the prescribed purpose.

A rating of fair means the element of wildlife habitat and habitats can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results, however.

A rating of poor means the elements of wildlife and limitations for the designated use are rather severe. Habitats can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of very poor means the element of wildlife habitat and limitations for the designated use are very severe and that unsatisfactory results are expected. It is either impossible or impractical to create, improve, or maintain habitats on soils in this category.

Explanations of the subheadings under "Elements of wildlife habitat" and "Kinds of wildlife" in table 3 are given in the following paragraphs.

Elements of Wildlife Habitat

Each soil is rated in table 3 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, selection of a site for development as a habitat for wildlife requires inspection at the site.

Grain and seed crops are annual grain-producing plants, such as corn, sorghum, and oats.

Grasses and legumes are domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include Kleingrass, fescue, and Johnsongrass. Legumes include annual lespedeza and sweet clover.

Wild herbaceous plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Beggarweed, perennial lespedeza, wild bean, pokeweed, and dovewood are typical examples. On range, typical plants are bluestem, grama, perennial forbs, and legumes.

Shrubs are nonconiferous shrubs that produce wildlife food in the form of twigs, acorns, buds, foliage, or browse. Such plants commonly grow in their natural environment, but they can be planted and developed through a wildlife management program. Typical species in this category are oak, dogwood, catclaw, greenbrier, and yaupan.

Wetland food and cover plants are annual and perennial herbaceous plants that grow wild on moist and

Figure 22.—Fishing and recreation area of the Guadalupe River on Seguin soils.

wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples of plants are smartweed, wild millet, and sedges. Submerged and floating aquatics are not included in this category

Shallow-water developments are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments that grow submerged aquatics.

Kinds of Wildlife

Table 3 rates soils according to their suitability as habitat for the three kinds of wildlife in the county—open land, rangeland, and wetland. These ratings are related to ratings made for the elements of wildlife habitat. For example, soils rated very poor for shallow-water developments are rated very poor for wetland wildlife.

Open land wildlife are birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, cottontail and jackrabbit, and fox are typical examples of open-land wildlife.

Rangeland wildlife are birds and mammals that normally live in natural range. Deer, squirrel, raccoon, quail, and meadowlark are typical examples.

Wetland wildlife are birds and mammals that normally live in wet areas, marshes, and swamps. Duck, geese, and heron are typical examples.

Use of the Soils for Recreational Development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 4 the soils of Guadalupe County are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails.

In table 4 the soils are rated as having slight,

TABLE 3.—*Interpretations of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Altoga:			
AlC3	Fair	Good	Poor
AlE3	Poor	Fair	Poor
Arenosa: ArD	Poor	Poor	Fair
Austin: AuB, AuC3	Fair	Good	Poor
Barbarosa: BaA, BaB	Good	Good	Poor
Bosque: Bo	Very poor	Poor	Fair
For Seguin part, see Seguin series.			
Branyon: BrA, BrB	Good	Good	Poor
Burleson: BuA, ByA, ByB	Good	Good	Poor
Crockett:			
CfA	Fair	Fair	Good
CfB	Fair	Good	Good
CgC, CsC3	Fair	Good	Good
CsD4	Poor	Fair	Good
Darst: DgE	Poor	Fair	Good
Demona: DmC	Fair	Good	Good
Doss: DoB	Fair	Good	Poor
Eddy: EgC	Poor	Fair	Poor
Ferris: FhF3	Poor	Fair	Poor
For Heiden part, see Heiden series, unit HeD3.			
Heiden:			
HeB	Good	Good	Poor
HeC, HeC3, HeD3	Fair	Good	Poor
Houston Black:			
HoA, HoB, HpB	Good	Good	Poor
HpC	Fair	Good	Poor
Jedd	Poor	Fair	Good
Mapped only in complex with Nebgen soils.			
Lewisville: LeA, LeB	Good	Good	Poor
Mabank:			
MaA	Fair	Fair	Good
MaB, MaB3	Fair	Good	Good
Nebgen: NcF	Very poor	Very poor	Poor
For Jedd part, see Jedd series.			
Patilo: PaD	Poor	Poor	Good
For Arenosa part, see Arenosa series.			
Queeny: QeC, QeF	Poor	Poor	Poor
Quihi: QgC	Poor	Poor	Fair
Seguin:			
Se	Good	Good	Fair
Bo (Seguin part)	Very poor	Poor	Fair
Sunev:			
SuA, SuB	Good	Good	Good
SuC3	Fair	Good	Good

of wildlife habitat and for kinds of wildlife

Elements of wildlife habitat—continued			Kinds of wildlife		
Shrubs	Wetland food and cover plants	Shallow-water developments	Open land	Rangeland	Wetland
Fair	Poor	Very poor	Fair	Poor	Very poor.
Fair	Very poor	Very poor	Poor	Poor	Very poor.
Fair	Very poor	Very poor	Poor	Fair	Very poor.
Fair	Poor	Very poor	Fair	Poor	Very poor.
Fair	Poor	Very poor	Fair	Poor	Very poor.
Good	Poor	Very poor	Poor	Fair	Very poor.
Poor	Poor	Poor	Fair	Poor	Poor.
Poor	Poor	Poor	Fair	Poor	Poor.
Good	Poor	Poor	Fair	Good	Poor.
Good	Poor	Poor	Good	Good	Poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Fair	Good	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Poor	Poor	Very poor	Fair	Poor	Very poor.
Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Poor	Very poor	Very poor	Poor	Poor	Very poor.
Poor	Poor	Very poor	Fair	Poor	Very poor.
Poor	Poor	Very poor	Fair	Poor	Very poor.
Poor	Poor	Very poor	Fair	Poor	Very poor.
Poor	Poor	Very poor	Fair	Poor	Very poor.
Fair	Very poor	Very poor	Fair	Fair	Very poor.
Fair	Poor	Very poor	Fair	Poor	Very poor.
Good	Fair	Fair	Fair	Good	Fair.
Good	Fair	Fair	Good	Good	Fair.
Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Good	Poor	Very poor	Fair	Good	Very poor.
Very poor	Very poor	Very poor	Poor	Very poor	Very poor.
Fair	Poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Fair	Very poor.
Good	Poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.

TABLE 3.—*Interpretations of the soils for elements*

Soil series and map symbols	Elements of wildlife habitat		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants
Trinity:			
Tr	Good	Good	Poor
Tw	Very poor	Poor	Poor
Uhland:			
Uh	Good	Good	Good
Uw	Very poor	Poor	Fair
Vernia: VrC	Poor	Poor	Fair
Windthorst:			
WdB	Good	Good	Good
WdC3	Fair	Good	Good

moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry; are free of flooding during the season of use; and do not have slopes or stoniness that greatly increases cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rain but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Use of the Soils for Gardening and Landscaping

Suburban homeowners and others who garden and landscape need to know the suitability and limitations of soils for growing flowers, shrubs, trees, fruits, and vegetables.

In tables 5, 6, 7, and 8 the soils of Guadalupe County are grouped according to texture, reaction, and other characteristics that affect suitability for garden and yard plants. Each group is rated according to the relative suitability of the soils for specified plants, and some of the limitations and management needs are noted. The Gardening and Landscaping Group in which each soil has been placed can be learned by referring to the "Guide to Mapping Units."

A rating of "good" indicates that soils have only minor limitations; "fair" that soils have one or two major limitations; "poor" that soils have many major limitations.

The ideal soils for yard and garden plants are those that have a deep root zone, a loamy texture, a balanced supply of plant nutrients, plenty of organic matter in various stages of decomposition, adequate available water capacity, good drainage, and a granular structure that allows free movement of water, air, and roots. A degree of acidity or alkalinity suitable is also important for the particular plants to be grown. Roses, most annual flowers, most vegetables, and most grasses grow best in soils that are neutral or only slightly acid. Some other plants, azaleas and rhododendrons for example, need acid soils.

Many kinds of soils are in Guadalupe County, and many of them differ considerably from the ideal in texture, depth, permeability, and other characteristics that affect their suitabiliy for flowers, shrubs, trees, and vegetables. Success in gardening and landscaping depends on recognition of the limitations of the soils for such uses and on the practice of management that will offset the limitations.

of wildlife habitat and for kinds of wildlife—Continued

Elements of wildlife habitat—continued			Kinds of wildlife		
Shrubs	Wetland food and cover plants	Shallow-water developments	Open land	Rangeland	Wetland
Fair	Poor	Poor	Fair	Poor	Poor.
Fair	Poor	Fair	Poor	Poor	Poor.
Good	Fair	Fair	Good	Good	Fair.
Good	Fair	Fair	Poor	Fair	Fair.
Good	Poor	Very poor	Poor	Fair	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.
Good	Poor	Very poor	Good	Good	Very poor.

Engineering Uses of the Soils[3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to predict performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 9, 10, and 11, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 9, 10, and 11, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning in soil science but are not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering Soil Classification Systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system[4] used by the SCS engineers, Department of Defense, and others, and the AASHTO system[5] adopted by the American Association of State Highway and Transportation Officials.

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic

[3] JERRY HOLLIGAN, engineer, Soil Conservation Service, helped prepare this section.

[4] United States Department of Defense. 1968. Unified soil classification system for roads, airfields, embankments and foundations. MIL-STD-619B, 30 pp., illus.

[5] American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

TABLE 4.—*Limitations of the soils for recreational development*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils]

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Altoga: AlC3, AlE3	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Arenosa: ArD	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Austin: AuB, AuC3	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Barbarosa: BaA, BaB	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Bosque: Bo For Seguin part, see Seguin series.	Severe: floods	Moderate: floods	Severe: floods	Slight.
Branyon: BrA, BrB	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: percs slowly; too clayey.	Severe: too clayey.
Burleson: BuA, ByA, ByB	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: percs slowly; small stones; too clayey.	Severe: too clayey.
Crockett: CfA, CfB	Severe: percs slowly	Slight	Severe: percs slowly	Slight.
CgC	Severe: percs slowly	Moderate: small stones.	Severe: percs slowly; small stones.	Moderate: small stones.
CsC3, CsD4	Severe: percs slowly	Moderate: erodes easily.	Severe: percs slowly	Moderate: erodes easily.
Darst: DgE	Severe: small stones	Severe: small stones	Severe: slope; small stones.	Severe: small stones.
Demona: DmC	Moderate: too sandy	Moderate: too sandy	Severe: too sandy	Moderate: too sandy.
Doss: DoB	Severe: too clayey	Severe: too clayey	Severe: depth to rock; too clayey.	Severe: too clayey.
Eddy: EgC	Moderate: small stones.	Moderate: small stones.	Severe: depth to rock; small stones.	Moderate: small stones.
Ferris: FhF3 For Heiden part, see Heiden series.	Severe: percs slowly; slope; too clayey.	Severe: slope; too clayey.	Severe: percs slowly; slope; too clayey.	Severe: too clayey.
Heiden: HeB, HeC, HeC3, HeD3	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: percs slowly; too clayey.	Severe: too clayey.
Houston Black: HoA, HoB, HpB, HpC.	Severe: percs slowly; too clayey.	Severe: too clayey	Severe: percs slowly; small stones; too clayey.	Severe: too clayey.
Jedd Mapped only in complex with Nebgen series.	Severe: large stones; slope.	Severe: slope	Severe: large stones; slope.	Severe: large stones.
Lewisville: LeA, LeB	Severe: too clayey	Severe: too clayey	Severe: too clayey	Severe: too clayey.
Mabank: MaA, MaB, MaB3	Severe: percs slowly; wet.	Moderate: wet	Severe: percs slowly; wet.	Moderate: wet.
Nebgen: NcF For Jedd part, see Jedd series.	Severe: large stones; slope.	Severe: large stones; slope.	Severe: depth to rock; large stones; slope.	Severe: large stones.
Patilo: PaD For Arenosa part, see Arenosa series.	Severe: too sandy	Severe: too sandy	Severe: too sandy	Severe: too sandy.
Queeny: QeC	Slight	Slight	Severe: depth to rock.	Slight.
QeF	Moderate: slope	Moderate: slope	Severe: depth to rock; slope.	Slight.

TABLE 4.—*Limitations of the soils for recreational development*—Continued

Soil series and map symbols	Camp areas	Picnic areas	Playgrounds	Paths and trails
Quihi: QgC	Moderate: percs slowly; small stones.	Moderate: small stones.	Moderate: percs slowly; small stones.	Moderate: small stones.
Seguin: Se	Severe: floods	Moderate: floods; too clayey.	Severe: floods	Moderate: too clayey.
Sunev:				
SuA, SuB	Slight	Slight	Slight	Slight.
SuC3	Slight	Slight	Moderate: slope	Slight.
Trinity: Tr, Tw	Severe: floods; percs slowly; too clayey.	Severe: too clayey	Severe: floods; percs slowly; too clayey.	Severe: too clayey.
Uhland:				
Uh	Severe: floods; wet	Moderate: floods; wet.	Severe: floods; wet	Moderate: wet.
Uw	Severe: floods; wet	Severe: floods	Severe: floods; wet	Moderate: wet.
Vernia: VrC	Severe: small stones	Severe: small stones	Severe: small stones; too sandy.	Severe: small stones.
Windthorst: WdB, WdC3	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.

soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soil for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 11; the estimated classification, without group index numbers, is given in table 9 for all soils mapped in the survey area.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Estimated Soil Properties Significant to Engineering

Several estimated soil properties significant in engineering are given in table 9. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 9.

Hydrologic soil groups give the runoff potential from rain. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of long duration storms occurring after prior wetting and opportunity for swelling, and without the protective effects of vegetation.

Soils in hydrologic group A have high infiltration rates even when thoroughly wetted. They are chiefly deep, well-drained to excessively drained sands or gravels. These soils have a high rate of water transmission and a low runoff potential.

Soil in hydrologic group B have moderate infiltration rates when thoroughly wetted. They are chiefly moderately deep to deep, moderately well drained to well drained soils of moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Soils in hydrologic group C have slow infiltration rates when thoroughly wetted. They are chiefly soils that have a layer that impedes the downward movement of water or soils of moderately fine to fine texture. These soils have a slow rate of water transmission.

Soils in hydrologic group D have very slow infiltration rates when thoroughly wetted. They are chiefly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils that overlie nearly impervious material. These soils have a very slow rate of water transmission and a high runoff potential.

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years. This column is not included on the table since the soils of Guadalupe

TABLE 5.—*Suitability of the soils for flowers*

[Absence of data indicates that flowers are not rated for the soil group]

Soil groups and map symbols	Good	Fair	Poor
Group 1: Deep, neutral to slightly acid, moderately well drained to well drained loamy fine sands, fine sands, and very gravelly loamy sands. ArD, DmC, PaD, VrC.	Agapanthus, anemone, aster (perennial), caladium, canna, cornflower, crocus, gladiolus, daisy (shasta), hibiscus, hyacinth, marguerite, pansy, petunia, phlox (perennial), poppy (oriental), ranunculus, scilla, sweetpea, zinnia.	Amaryllis, aster (annual), bleedingheart, dahlia, daylily, hollyhock, lily, snapdragon, stock.	Bird-of-paradise, chrysanthemum.
Group 2: Moderately deep to deep, mildly alkaline to moderately alkaline, well-drained loams, silty clay loams, and silty clays. AlC3, AlE3, AuB, AuC3, BaA, BaB, Bo, LeA, LeB, Se, SuA, SuB, SuC3.	Amaryllis, cornflower, crocus, gladiola, daisy (shasta), hibiscus, hollyhock, marguerite, marigold, pansy, petunia, poppy (oriental), scilla, zinnia.[1]	Agapanthus, anemone, aster (annual), aster (perennial), bird-of-paradise, bleedingheart, caladium, canna, chrysanthemum, dahlia, daylily, hyacinth, lily, ranunculus, snapdragon, sweetpea, stock.[1]	Phlox (perennial).[1]
Group 3: Deep, slightly acid to mildly alkaline, moderately well drained to somewhat poorly drained clay loams, fine sandy loams, and loams. CfA, CfB, CgC, CsC3, CsD4, MaA, MaB, MaB3, Uh, Uw, WdB, WdC3.	Amaryllis, aster (perennial), canna, cornflower, daisy (shasta), hollyhock, hyacinth, marguerite, petunia, poppy (oriental), zinnia.	Anemone, aster (annual), bird-of-paradise, bleedingheart, caladium, chrysanthemum, gladiolus, dahlia, daylily, hibiscus, lily, marigold, pansy, phlox (perennial), ranunculus, scilla, snapdragon, sweetpea, stock.	Agapanthus, crocus.
Group 4: Deep, neutral to moderately alkaline, well-drained to somewhat poorly drained clays and gravelly clays. BrA, BrB, BuA, ByA, ByB, FhF3, HeB, HeC, HeC3, HeD3, HoA, HoB, HpB, HpC, Tr, Tw.	Amaryllis, bird-of-paradise, cornflower, daisy (shasta), hollyhock, marguerite, marigold, petunia, poppy (oriental), zinnia.[1]	Anemone, aster (annual), aster (perennial), canna, crocus, gladiola, daylily, hibiscus, hyacinth, lily, pansy, ranunculus, scilla, sweetpea.[1]	Agapanthus, bleedingheart, caladium, chrysanthemum, dahlia, phlox (perennial), snapdragon, stock.[1]
Group 5: Very shallow to moderately deep, mildly alkaline to moderately alkaline, well-drained gravelly loams, gravelly clay loams, and silty clays. DoB, EgC, QeC, QeF, QgC.	----------	Amaryllis (shallow or moderately deep soils), aster (perennial), bird-of-paradise, cornflower, hibiscus, hollyhock, marguerite, petunia, poppy (oriental), scilla (shallow or moderately deep soils), zinnia.[1]	Agapanthus, amaryllis (very shallow soils), anemone, aster (annual), bleedingheart, caladium, canna, chrysanthemum, crocus, gladiolus, dahlia, daylily, hyacinth, lily, marigold, pansy, phlox (perennial), ranunculus, scilla (gravelly or very shallow soils), snapdragon, sweetpea, stock.[1]
Group 6: Very shallow to moderately deep, medium to slightly acid, well-drained, very gravelly to cobbly sandy loams. DgE, NcF.	----------	Aster (perennial), bird-of-paradise, cornflower, hibiscus, hollyhock, marguerite, petunia, poppy (oriental), zinnia.	Agapanthus, amaryllis, anemone, aster (annual), bleedingheart, caladium, canna, chrysanthemum, crocus, gladiola, dahlia, daylily, hyacinth, lily, marigold, pansy, phlox (perennial), ranunculus, scilla, snapdragon, sweetpea, stock.

[1] The high lime content of some of the soils may cause iron chlorosis in some flowers. Add iron chelates to the soil to correct the chlorosis problem. Addition of sulphur to the soil will also help correct high lime problems.

TABLE 6.—*Suitability of the soils for shrubs*

[A dash in the column indicates that shrubs are not rated for this soil group]

Soil groups and map symbols	Good	Fair	Poor
Group 1: Deep, neutral to slightly acid, moderately well drained to well drained loamy fine sands, fine sands, and very gravelly loamy sands. ArD, DmC, PaD, VrC.	Azalea, Barbados-cherry, bottlebrush, bougainvillaea, butterflybush, bridalwreath, camellia, gardenia, goldflower, guava, jasmine (yellow), mockorange, oleander, pyracantha, quince (flowering).	Duranta, hydrangea	----------
Group 2: Moderately deep to deep, mildly alkaline to moderately alkaline, well-drained loams, silty clay loams, and silty clays. AlC3, AlE3, AuB, AuC3, BaA, BaB, Bo, LeA, LeB, Se, SuA, SuB, SuC3.	Barbados-cherry, bottlebrush, bougainvillaea, bridalwreath, duranta, goldflower, guava, jasmine (yellow), oleander, quince (flowering).[1]	Pyracantha[1]	Azalea, butterflybush, camellia, gardenia, hydrangea, mockorange.[1]
Group 3: Deep, slightly acid to mildly alkaline, moderately well drained to somewhat poorly drained clay loams, fine sandy loams, and loams. CfA, CfB, CgC, CsC3, CsD4, MaA, MaB, MaB3, Uh, Uw, WdB, WdC3.	Barbados-cherry, bottlebrush, bougainvillaea, bridalwreath, goldflower, guava, jasmine (yellow), oleander, pyracantha, quince.	Azalea, camellia, duranta, gardenia.	Butterflybush, hydrangea.
Group 4: Deep, neutral to moderately alkaline, well-drained to somewhat poorly drained clays and gravelly clays. BrA, BrB, BuA, ByA, ByB, FhF3, HeB, HeC, HeC3, HeD3, HoA, HoB, HpB, HpC, Tr, Tw.	Barbados-cherry, bottlebrush, bougainvillaea, bridalwreath, duranta, goldflower, guava, jasmine (yellow), oleander, quince (flowering).[1]	Pyracantha[1]	Azalea, butterflybush, camellia, gardenia, hydrangea, mockorange.[1]
Group 5: Very shallow to moderately deep, mildly alkaline to moderately alkaline, well-drained gravelly loams, gravelly clay loams, and silty clays. DoB, EgC, QeC, QeF, QgC.	----------	Barbados-cherry, bottlebrush, bougainvillaea, bridalwreath, (shallow or moderately deep soils), goldflower, guava, oleander, quince (flowering).[1]	Azalea, Barbados-cherry, bottlebrush, bougainvillaea, butterflybush, bridalwreath, (very shallow soils), camellia, duranta, gardenia, hydrangea, jasmine (yellow), mockorange, pyracantha.[1]
Group 6: Very shallow to moderately deep, medium acid to slightly acid, well-drained, very gravelly to cobbly sandy loams. DgE, NcF.	----------	Bougainvillaea, bridalwreath, goldflower, guava, oleander, quince (flowering).[1]	Azalea, Barbados-cherry, bottlebrush, butterflybush, camellia, duranta, gardenia, hydrangea, jasmine (yellow), mockorange, pyracantha.

[1] The high lime content of some of the soils may cause iron chlorosis in some shrubs. Add iron chelates to the soil to correct the chlorosis problem. Addition of sulphur to the soil will also help correct the high lime problem.

County do not have water tables near the surface except Uhland soils which have a water table at a depth of 36 inches in spring and fall.

Soil texture is described in table 9 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased

TABLE 7.—*Suitability of the soils for trees*

[Absence of data indicates that trees are not rated for the soil group]

Soil groups and map symbols	Good	Fair	Poor
Group 1: Deep, neutral to slightly acid, moderately well drained to well drained loamy fine sands, fine sands, and very gravelly loamy sands. ArD, DmC, PaD, VrC.	Arborvitae, ash (Arizona), capejasmine, cedrus deodara, cherry (flowering), crabapple (flowering), crapemyrtle, dogwood, elm (American), Halepensis, Japanese black pine, live oak, magnolia, peach, pecan, plum, sycamore.		
Group 2: Moderately deep to deep, mildly alkaline to moderately alkaline, well-drained loams, silty clay loams, and silty clays. AlC3, AlE3, AuB, AuC3, BaA, BaB, Bo, LeA, LeB, Se, SuA, SuB, SuC3.	Arborvitae, ash (Arizona), crapemyrtle, elm (American), Halepensis, Japanese black pine, live oak, magnolia, peach, pecan, plum, sycamore.[1]	Cedrus deodara[1]	Capejasmine, cherry (flowering), crabapple (flowering), dogwood.[1]
Group 3: Deep, slightly acid to mildly alkaline, moderately well drained to somewhat poorly drained clay loams, fine sandy loams, and loams. CfA, CfB, CgC, CsC3, CsD4, MaA, MaB, MaB3, Uh, Uw, WdB, WdC3.	Arborvitae, ash (Arizona), Cedrus deodara, crapemyrtle, elm (American), Halepensis, Japanese black pine, live oak, magnolia, pecan, plum, sycamore.	Capejasmine, dogwood, peach	Cherry (flowering), crabapple (flowering).
Group 4: Deep, neutral to moderately alkaline, well-drained to somewhat poorly drained clays and gravelly clays. BrA, BrB, BuA, ByA, ByB, FhF3, HeB, HeC, HeC3, HeD3, HoA, HoB, HpB, HpC, Tr, Tw.	Arborvitae, ash (Arizona), crapemyrtle, elm (American), Halepensis, Japanese black pine, live oak, magnolia, pecan, plum, sycamore.[1]	Cedrus deodara, peach[1]	Capejasmine, cherry (flowering), crabapple, dogwood.[1]
Group 5: Very shallow to moderately deep, mildly alkaline to moderately alkaline, well-drained gravelly loams, gravelly clay loams, and silty clays. DoB, EgC, QeC, QeF, QgC.	Live oak[1]	Arborvitae, ash (Arizona), cedrus deodara, crapemyrtle, elm (American), Halepensis, Japanese black pine, magnolia, peach, pecan, plum, sycamore.[1]	Capejasmine, cherry (flowering), crabapple (flowering), dogwood.[1]
Group 6: Very shallow to moderately deep, medium acid to slightly acid, well-drained very gravelly to cobbly sandy loams. DgE, NcF.	Live oak	Arborvitae, ash (Arizona), cedrus deodara, crapemyrtle, elm (American), Halepensis, Japanese black pine, magnolia, peach, pecan, plum, sycamore.	Capejasmine, cherry (flowering), crabapple (flowering), dogwood.

[1] The high lime content of the soil may cause iron chlorosis in some trees. Add iron chelates to the soil to correct the chlorosis problem. Addition of sulphur to the soil will also help correct the high lime problem.

from a dry state, the material changes from a semisolid to a plastic. If the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic; and the liquid limit, from a plastic to a liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 9, but in table 11 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it

TABLE 8.—*Suitability of the soils for vegetables and fruits*

[Absence of data indicates that vegetables are not rated for the soil group]

Soil groups and map symbols	Good	Fair	Poor
Group 1: Deep, neutral to slightly acid, moderately well drained to well drained loamy fine sands, fine sands, and very gravelly loamy sands. ArD, DmC, PaD, VrC.	Watermelon	Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip.	
Group 2: Moderately deep to deep, mildly alkaline to moderately alkaline, well-drained loams, silty clay loams, and silty clays. AlC3, AlE3, AuB, AuC3, BaA, BaB, Bo, LeA, LeB, Se, SuA, SuB, SuC3.	Blackberry, broccoli, cabbage, cantaloupe, cauliflower, cucumber, onion, parsley, pea, radish, spinach, squash, sweet corn, tomato.	Bean, beet, brussel sprout, carrot, lettuce, okra, pepper, Irish potato, pumpkin, strawberry, turnip.	Asparagus, sweet potato, mustard, watermelon.
Group 3: Deep, slightly acid to mildly alkaline, moderately well drained to somewhat poorly drained fine sandy loams, clay loams, and loams. CfA, CfB, CgC, CsC3, CsD4, MaA, MaB, MaB3, Uh, Uw, WdB, WdC3.		Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip, watermelon.	
Group 4: Deep, neutral to moderately alkaline, well-drained to somewhat poorly drained clays and gravelly clays. BrA, BrB, BuA, ByA, ByB, FhF3, HeB, HeC, HeC3, HeD3, HoA, HoB, HpB, HpC, Tr, Tw.		Bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, okra, onion, parsley, pea, radish, spinach, squash, strawberry, sweet corn, tomato.	Asparagus, mustard, pepper, Irish potato, sweet potato, pumpkin, turnip, watermelon.
Group 5: Very shallow to moderately deep, mildly alkaline to moderately alkaline, well-drained gravelly loams, gravelly clay loams, and silty clays. DoB, EgC, QeC, QeF, QgC.			Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip, watermelon.
Group 6: Very shallow to moderately deep, medium acid to slightly acid, well-drained very gravelly to cobbly sandy loams. DgE, NcF.			Asparagus, bean, beet, blackberry, broccoli, brussel sprout, cabbage, cantaloupe, carrot, cauliflower, cucumber, lettuce, mustard, okra, onion, parsley, pea, pepper, Irish potato, sweet potato, pumpkin, radish, spinach, squash, strawberry, sweet corn, tomato, turnip, watermelon.

TABLE 9.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column of this table. Absence of data indicates that the

Soil series and map symbols	Hydrologic group	Depth to rock	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		In	*In*				*Pct*
Altoga: AlC3, AlE3	C	>60	0–7	Silty clay	CL or CH	A–6, A–7–6	
			7–20	Silty clay	CL or CH	A–7–6, A–6	
			20–35	Silty clay	CL	A–7–6, A–6	
			35–72	Silty clay	CL	A–7–6, A–6	
Arenosa: ArD	A	>60	0–96	Fine sand	SP–SM, SM	A–2–4, A–3	
Austin: AuB, AuC3	C	20–32	0–18	Silty clay	CH or CL	A–7–6	0–5
			18–28	Silty clay	CH or CL	A–7–6	
			28–42	Silty clay loam	CH or CL	A–7–6, A–6	
			42–45	Platy chalk.			
Barbarosa: BaA, BaB	D	>60	0–24	Silty clay	CH or CH–MH	A–7–6 or A–7–5	
			24–48	Clay	CH	A–7–6	
			48–72	Clay	CH	A–7–6	
*Bosque: Bo	B	>60	0–24	Loam	CL	A–6, A–4	
For Seguin part, see Seguin series.			24–38	Loam	CL	A–6, A–4	
			38–60	Silty clay loam	CL	A–6, A–4, A–7–6	
Branyon: BrA, BrB	D	>60	0–64	Clay	CH	A–7–6	
			64–76	Silty clay loam	CH, CL, GC, SC	A–7–6, A–6 A–2, A–4	0–10
Burleson:							
BuA	D	>60	0–60	Clay	CH	A–7–6	
ByA, ByB			0–6	Gravelly clay	CH, GC, SC	A–7–6, A–2–7	0–5
			6–60	Clay	CH	A–7–6	
Crockett:							
CfA, CfB, CsC3, CsD4	D	>60	0–8	Fine sandy loam, loam	SM, ML, SC, CL, CL–ML	A–4, A–6	
			8–62	Clay	SM–SC	A–7–6, A–6	
			62–72	Sandy loam and clay.			
CgC		>60	0–10	Gravelly sandy loam	GM, GC, GM–GC, SM, SC, SM–SC	A–2, A–1	0–5
			10–44	Clay and sandy clay	CH, CL	A–7–6, A–6	
			44–60	Shaly clay interbedded with sand. (Too variable to rate)			
Darst: DgE	C	20–40	0–8	Very gravelly sandy loam.	GP, GM, SP, GP–GM, SP–SM, GM–GC, SM, SM–SC	A–1, A–2–4	5–20
			8–30	Clay	CH, SC, CL	A–7–6	0–2
			30–37	Sandy clay	CL, SC	A–7–6, A–6	0–5
			37–50	Mudstone and strongly cemented sandstone. (Too variable to rate)			

significant to engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the soil is too variable to be rated or that no estimate was made. The symbol > means more than; the symbol < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
100	95–100	85–100	80–95	40–51	20–31	0.6–2.0	0.15–0.18	7.9–8.4	High		
		100	95–100	40–51	20–31	0.6–2.0	0.15–0.18	7.9–8.4	High	Moderate	Low.
		100	95–99	30–48	20–25	0.6–2.0	0.15–0.18	7.9–8.4	Moderate	Moderate	Low.
		100	95–99	30–48	15–30	0.6–2.0	0.13–0.17	7.9–8.4	Low	Moderate	Low.
95–100	95–100	60–90	10–20	<20	[1] NP–3	>20.0	0.05–0.08	5.6–6.5	Very low	Low	Moderate.
95–100	95–100	80–100	75–95	45–60	25–40	0.2–0.6	0.15–0.20	7.9–8.4	High	High	Low.
95–100	90–100	80–100	75–95	45–60	20–35	0.2–0.6	0.15–0.20	7.9–8.4	Moderate	High	Low.
100	95–100	95–100	85–95	40–60	18–35	0.2–0.6	0.15–0.20	7.9–8.4	Very low	Moderate	Low.
100	85–100	85–100	80–95	51–65	25–35	0.2–0.6	0.14–0.19	7.4–8.4	High	High	Low.
100	85–100	85–100	80–95	55–70	30–40	0.06–0.2	0.14–0.19	7.9–8.4	High	High	Low.
83–93	75–85	70–80	62–72	51–65	27–37	0.2–0.6	0.14–0.19	7.9–8.4	High	High	Low.
100	95–100	80–95	60–75	30–40	10–20	0.6–2.0	0.15–0.17	7.9–8.4	Low	High	Low.
100	95–100	95–100	60–75	30–40	10–20	0.6–2.0	0.15–0.17	7.9–8.4	Low	High	Low.
100	95–100	95–100	60–80	30–45	10–25	0.6–2.0	0.15–0.18	7.9–8.4	Low	High	Low.
95–100	95–100	90–100	85–95	60–90	35–65	<0.06	0.15–0.18	7.9–8.4	Very high	Very high	Low.
40–100	35–100	30–100	25–100	25–90	8–65	0.06–2.0	0.11–0.18	7.9–8.4	High		
99–100	98–100	85–100	80–95	51–75	30–55	<0.06	0.15–0.20	6.6–8.4	Very high	High	Low.
35–75	35–75	30–75	20–70	51–75	30–55	<0.06	0.15–0.20	6.6–7.8	Very high	High	Low.
95–100	98–100	85–100	80–95	51–75	30–55	<0.06	0.15–0.20	7.4–8.4	Very high	High	Low.
95–100	95–100	95–100	36–95	15–35	3–15	0.6–2.0	0.13–0.14	6.1–7.3	Low	High	Low.
95–100	90–100	80–100	65–90	40–50	20–35	<0.06	0.15–0.18	5.6–7.8	High	High	Low.
35–65	35–65	30–45	13–25	15–35	3–15	0.6–2.0	0.05–0.10	6.1–7.3	Low	High	Low.
95–100	90–100	80–100	65–90	40–55	20–35	<0.06	0.15–0.18	5.6–7.8	High	High	Low.
25–75	25–75	15–45	2–25	24	NP–7	2.0–6.0	0.05–0.10	5.6–6.5	Low	High	Moderate.
90–100	80–100	80–100	45–90	41–55	18–35	0.2–0.6	0.15–0.20	4.5–6.0	Moderate	High	Moderate.
90–100	80–100	80–100	45–65	30–45	15–30	0.2–0.6	0.15–0.20	4.5–5.0	Moderate	High	High.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to rock	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		In	*In*				*Pct*
Demona: DmC	C	>60	0–24	Loamy fine sand	SM, SM-SC	A-2-4	
			24–60	Clay, sandy clay	CH, CL	A-7-6	
Doss: DoB	C	12–20	0–15	Silty clay, clay loam	MH	A-7-6	0–5
			15–20	Platy chalk.			
Eddy: EgC	C	3–10	0–4	Gravelly clay loam	GC	A-6, A-2	5–20
			4–10	Platy chalk.			
*Ferris: FhF3	D	>60	0–60	Clay, shaly clay	CH	A-7-6	
For Heiden part, see Heiden series.							
Heiden: HeB, HeC, HeC3, HeD3	D	>60	0–84	Clay, shaly clay	CH	A-7-6	
Houston Black:							
HoA, HoB	D	>60	0–60	Clay	CH	A-7-6	
HpB, HpC	D	>60	0–12	Gravelly clay	GC, CH	A-2-7, A-7-6	0–5
			12–60	Clay	CH	A-7-6	
Jedd	C	20–26	0–10	Cobbly sandy loam	GM, SM, SM-SC, GP-GM, SP-SM, GM-GC	A-2-4	5–50
Mapped only in complex with Nebgen soils.			10–24	Sandy clay	CL, SC	A-7-6, A-6	
			24–28	Weakly cemented sandstone.			
Lewisville: LeA, LeB	B	>60	0–37	Silty clay	CH, CL	A-7-6	
			37–60	Silty clay loam	CH, CL	A-6, A-7-6	
Mabank: MaA, MaB, MaB3	D	>60	0–10	Loam	CL, CL-ML	A-4	
			10–66	Clay loam, clay	CL, CH	A-7-6	
*Nebgen: NcF	D	4–12	0–7	Cobbly or stony sandy loam.	SC, SM-SC	A-4, A-6	15–25
For Jedd part, see Jedd series.			7–14	Strongly cemented sandstone.			
*Patilo: PaD	C	>60	0–52	Fine sand	SM, SP-SM, SM-SC	A-2-4	
For Arenosa part of PaD, see Arenosa series.			52–84	Sandy clay loam	SC	A-2-6, A-6	
Queeny: QeC, QeF	D	4–12	0–9	Gravelly loam	SC, CL	A-6, A-7-6	0–5
			9–37	Strongly cemented platy and weakly cemented caliche.			
			37–144	Very gravelly sand	GW-GC, GC, GM	A-2-6, A-1	5–15
Quihi: QgC	C	20–40	0–12	Gravelly loam, gravelly clay loam.	SC, GC	A-6, A-2-6	0–15
			12–38	Very gravelly or gravelly clay.	GC, GP-GC	A-7-6, A-2-7	0–15
			38–48	Strongly cemented or platy caliche.			
Seguin: Se	B	>60	0–62	Silty clay loam	CL	A-6, A-7-6	
Sunev: SuA, SuB, SuC3	B	>60	0–12	Loam	CL, SC	A-4, A-6	
			12–21	Loam	CL-ML, CL	A-4, A-6	
			21–72	Loam	CL-ML, CL	A-4, A-6	

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
90–100	90–100	60–98	15–30	19–30	2–6	2.0–6.0	0.05–0.10	5.6–7.3	Very low	High	Moderate.
90–100	90–100	90–100	51–85	42–65	30–45	0.2–0.6	0.15–0.18	5.1–7.8	Moderate	High	Moderate.
90–100	90–100	85–100	80–95	51–70	20–30	0.2–0.6	0.15–0.17	7.9–8.4	Moderate	Moderate	Low.
40–50	35–50	30–45	20–40	30–40	11–20	0.2–0.6	0.10–0.13	7.9–8.4	Low	High	Low.
98–100	95–100	80–95	85–95	51–70	35–50	<0.06	0.15–0.18	7.9–8.4	Very high	High	Low.
95–100	95–100	80–95	75–95	55–80	40–50	<0.06	0.15–0.18	7.9–8.4	Very high	High	Low.
95–100	95–100	95–100	85–100	55–110	35–90	<0.06	0.15–0.20	7.4–8.4	Very high	Very high	Low.
40–70	35–70	30–60	25–51	55–110	35–90	<0.06	0.15–0.20	7.4–8.4	Very high to high.		
95–100	95–100	95–100	85–100	55–110	35–90	<0.06	0.15–0.20	7.9–8.4	Very high	Very high	Low.
45–91	35–90	25–87	6–23	15–30	2–6	0.6–2.0	0.09–0.14	6.1–6.5	Low	High	Moderate.
90–100	90–100	70–95	45–60	35–48	15–28	0.2–0.6	0.13–0.17	5.1–6.0	Moderate	High	Moderate.
100	98–100	70–100	70–95	41–65	20–40	0.6–2.0	0.16–0.20	7.9–8.4	High	High	Low.
90–100	85–100	65–90	70–90	35–55	20–35	0.6–2.0	0.16–0.20	7.9–8.4	High	High	Low.
95–100	95–100	80–100	55–70	20–30	4–10	0.6–2.0	0.10–0.15	6.1–7.3	Low	High	Low.
95–100	95–100	95–100	70–85	42–65	25–40	<0.06	0.12–0.16	6.6–8.4	High	High	Low.
75–100	75–100	70–85	40–49	20–30	4–13	2.0–6.0	0.10–0.14	6.1–6.5	Low	Low	Low.
100	95–100	90–100	8–20	20–25	2–6	6.0–20.0	0.05–0.08	6.1–7.3	Very low	Low	Moderate.
90–100	90–100	90–100	25–49	20–35	11–20	0.2–0.6	0.14–0.18	5.1–6.9	Low	Low	Moderate.
60–95	60–95	50–95	40–70	30–45	12–20	0.6–2.0 0.06–0.20	0.11–0.13	7.9–8.4	Low	Moderate	Low.
25–35	17–27	10–20	5–15	<30	NP–15	2.0–6.0		7.9–8.4	Very low	Moderate	Low.
20–65	10–50	10–50	10–40	28–35	11–15	0.6–2.0	0.04–0.10	6.6–7.8	Low	High	Low.
20–60	10–50	10–50	10–45	41–60	20–35	0.2–0.6	0.02–0.08	6.6–8.4	Moderate	High	Low.
95–100	90–100	90–100	75–96	34–44	15–25	0.6–2.0	0.14–0.17	7.9–8.4	Moderate	Moderate	Low.
100	95–100	90–100	47–57	20–40	8–18	0.6–2.0	0.11–0.16	7.9–8.4	Low	Moderate	Low.
95–100	95–100	90–100	51–65	20–40	7–18	0.6–2.0	0.11–0.16	7.9–8.4	Low	Moderate	Low.
95–100	90–100	85–100	51–61	20–40	7–18	0.6–2.0	0.11–0.16	7.9–8.4	Low	Moderate	Low.

TABLE 9.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to rock	Depth from surface	USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		In	*In*				*Pct*
Trinity: Tr, Tw	D	>60	0–72	Clay	CH	A–7–6	
Uhland: Uh, Uw	B	>60	0–7	Clay loam	CL	A–6, A–7	0–10
			7–60	Fine sandy loam	SC, CL, CL–ML, SM–SC	A–4, A–6	0–10
Vernia: VrC	A	>60	0–44	Very gravelly loamy sand.	GP–GM	A–1	5–10
			44–72	Very gravelly or gravelly sandy clay loam.	GC, SC	A–2–6, A–2–7	2–5
			72–80	Gravelly sandy loam	GC, SC	A–2–6	2–5
Windthorst: WdB, WdC3	C	>60	0–8	Fine sandy loam	SM, SM–SC	A–4, A–2–4	
			8–36	Clay	CH, CL	A–7–6, A–6	
			36–72	Sandy clay loam	SC, CL	A–6, A–7–6	

[1] Nonplastic.

to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 9 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in micromhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete. The column was not included in the table since salinity of the soil material is not a concern in the county.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 9, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Subsidence is settlement of organic soils or of soils containing semifluid mineral layer. Ratings for subsidence take into account rapid initial loss of elevation resulting from drainage and lowering of the level of the ground water. They also take into account later and slower loss of elevation that results from oxidation of organic materials. The maximum possible loss of surface elevation is called potential subsidence. This column was not included on the table since this is not a concern of the soils of the county.

Engineering Interpretations

The estimated interpretations in table 10 are based on the engineering properties of soils shown in table 9, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Guadalupe County. In table 10 ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage of cropland and pasture, irrigation,

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity	
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							Uncoated steel	Concrete
				Pct		*In per hr*	*In per in of soil*	*pH*			
100	98–100	85–100	80–95	51–60	30–40	<0.06	0.15–0.20	7.4–8.4	Very high--	Very high--	Low.
95–100	95–100	95–100	70–90	35–45	18–25	0.2–0.6	0.15–0.20	6.1–7.8	Moderate --	Moderate --	Low.
95–100	90–100	80–100	44–90	25–35	5–12	0.2–0.6	0.10–0.14	6.1–7.8	Very low---	Moderate --	Low.
10–44	10–27	10–15	6–10	--------	NP	6.0–20.0	0.03–0.06	6.1–7.8	Very low---	Low -------	Low.
30–65	13–50	13–45	13–31	35–45	18–30	0.6–2.0	0.08–0.13	4.5–6.0	Very low---	Low -------	Low.
20–55	15–50	15–40	15–25	25–35	12–20	0.6–2.0	0.05–0.10	4.5–6.0	Very low---	Low -------	Low.
95–100	90–100	75–95	21–45	<21	NP–7	0.6–2.0	0.12–0.17	5.6–7.3	Low -------	High ------	Low.
95–100	95–100	85–100	51–90	35–55	20–35	0.2–0.6	0.15–0.20	5.6–7.8	High ------	High ------	Low.
90–100	90–100	75–100	36–85	30–45	16–30	0.2–0.6	0.15–0.20	6.1–8.4	Moderate --	High ------	Low.

ponds and reservoirs, embankments, and terraces and diversions. For these particular uses, table 10 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties are generally favorable for the rated use, or in other words, limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation, special designs, or intensive maintenance are required.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Explanations of some of the columns in table 10 are given in the following paragraphs.

Septic-tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, or compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, content of organic matter, and slope; and, if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted according to the Unified soil classification system and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings without basements, as rated in table 10, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil through the disposal period. Landfill areas are subject to heavy vehic-

TABLE 10.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The instructions for referring to other series that appear in the first column of this table. "Shrink-swell" and some of the other terms and other terms

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill	Local roads and streets
Altoga: AlC3	Moderate: seepage.	Moderate: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.
AlE3	Moderate: seepage; slope.	Severe: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.
Arenosa: ArD	Slight [1]	Severe: seepage.[1]	Severe: cut-banks cave.	Slight	Severe: seepage.[1]	Slight
Austin: AuB, AuC3	Severe: depth to rock; percs slowly.	Severe: depth to rock.	Moderate: depth to rock.	Severe: shrink-swell.	Severe: depth to rock; too clayey.	Severe: shrink-swell.
Barbarosa: BaA, BaB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
*Bosque: Bo For Seguin part, see Seguin series.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Branyon: BrA, BrB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Burleson: BuA, ByA, ByB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Crockett: CfA, CfB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
CsC3, CsD4	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
CgC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Darst: DgE	Severe: depth to rock; percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: low strength.	Severe: depth to rock.	Severe: low strength.
Demona: DmC	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey; wet.	Moderate: low strength; wet.	Moderate: too clayey; wet.	Severe: low strength.

properties of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," used to rate soils]

Degree and kind of limitation for—continued		Suitability as a source of—				Soil features affecting—		
Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Sand	Gravel	Topsoil	Drainage for crops and pastures	Irrigation	Terraces and diversions
Moderate: seepage.	Moderate: piping.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Slope	Slope	Slope.
Moderate: seepage.	Moderate: piping.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Slope	Slope	Slope.
Severe: seepage.	Severe: erodes easily; piping.	Good	Fair: excess fines.	Improbable source.	Poor: too sandy.	Not needed	Droughty; fast intake; seepage.	Not needed.
Severe: depth to rock.	Moderate: thin layer.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed	Percs slowly; slope.	Favorable.
Moderate: seepage.	Moderate: shrink-swell.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.[2]	Poor: too clayey.	Not needed	Percs slowly	Favorable.
Moderate: seepage.	Moderate: compressible.	Fair: low strength.	Improbable source.	Improbable source.	Good	Floods	Floods	Not needed.
Slight	Moderate: compressible.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Favorable	Percs slowly	Favorable.
Slight	Moderate: compressible.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Favorable	Percs slowly	Favorable.
Slight	Moderate: erodes easily.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: thin layer.	Favorable	Percs slowly	Favorable.
Slight	Moderate: erodes easily.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: thin layer.	Slope	Percs slowly; slope.	Slope.
Slight	Moderate: erodes easily.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: small stones.	Small stones; slope.	Percs slowly; slope.	Small stones.
Severe: depth to rock.	Moderate: thin layer.	Poor: low strength; thin layer.	Improbable source.	Improbable source.	Poor: small stones.	Depth to rock; slope.	Rooting depth; slope.	Rooting depth; slope.
Moderate: seepage.	Moderate: erodes easily; piping.	Poor: low strength.	Fair: excess fines.	Improbable source.	Poor: too sandy.	Not needed	Droughty; fast intake.	Erodes easily.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill	Local roads and streets
Doss: DoB	Severe: depth to rock; percs slowly.	Severe: depth to rock.	Moderate: depth to rock.	Severe: low strength.	Severe: depth to rock.	Severe: low strength.
Eddy: EgC	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
*Ferris: FhF3 For Heiden part, see Heiden series.	Severe: percs slowly; slope.	Severe: slope.	Severe: too clayey; slope.	Severe: shrink-swell; slope.	Severe: too clayey.	Severe: low strength; shrink-swell; slope.
Heiden: HeB, HeC, HeC3, HeD3	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: shrink-swell.
Houston Black: HoA, HoB, HpB	Severe: percs slowly.	Slight	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
HpC	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Severe: shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
Jedd Mapped only in complex with Nebgen soils.	Severe: depth to rock; large stones; percs slowly.	Severe: depth to rock.	Severe: depth to rock; large stones.	Severe: large stones.	Severe: depth to rock; large stones.	Severe: low strength; large stones.
Lewisville: LeA, LeB	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Severe: low strength; shrink-swell.	Severe: too clayey.[1]	Severe: low strength; shrink-swell.
Mabank: MaA, MaB, MaB3	Severe: percs slowly.	Slight	Severe: too clayey; wet.	Severe: low strength; shrink-swell.	Severe: too clayey.	Severe: low strength; shrink-swell.
*Nebgen: NcF For Jedd part, see Jedd series.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
*Patilo: PaD For Arenosa part, see Arenosa series.	Severe: percs slowly.	Severe: seepage.	Severe: cut-banks cave.	Slight	Severe: too sandy.[1]	Slight
Queeny: QeC, QeF	Severe: depth to rock.[1]	Severe: seepage.[1]	Moderate: depth to rock.	Slight	Severe: seepage.[1]	Moderate: depth to rock.

properties of the soils—Continued

Degree and kind of limitation for—continued		Suitability as a source of—				Soil features affecting—		
Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Sand	Gravel	Topsoil	Drainage for crops and pastures	Irrigation	Terraces and diversions
Severe: depth to rock; seepage.	Moderate: thin layer.	Poor: low strength; thin layer.	Improbable source.	Improbable source.	Poor: excess lime; too clayey.	Not needed	Droughty; percs slowly; rooting depth.	Rooting depth.
Severe: depth to rock.	Severe: depth to rock.	Poor: thin layer.	Improbable source.	Improbable source.	Poor: small stones.	Not needed	Droughty; rooting depth; slope.	Rooting depth.
Slight	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed	Percs slowly; slope.	Slope.
Slight	Moderate: shrink-swell; unstable fill.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed	Percs slowly; slope.	Favorable.
Slight	Moderate: erodes easily; shrink-swell.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed	Percs slowly; slope.	Favorable.
Slight	Moderate: erodes easily; shrink-swell.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed	Percs slowly; slope.	Favorable.
Severe: depth to rock.	Moderate: piping.	Poor: large stones; thin layer.	Improbable source.	Improbable source.	Poor: large stones; small stones.	Not needed	Droughty; rooting depth; slope.	Depth to rock; rock outcrops; slope.
Moderate: seepage.	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Not needed	Favorable	Favorable.
Slight	Moderate: shrink-swell; unstable fill.	Poor: low strength; shrink-swell.	Improbable source.	Improbable source.	Poor: thin layer.	Percs slowly; wet.	Percs slowly; wet.	Favorable.
Severe: depth to rock.	Moderate: piping; unstable fill.	Poor: thin layer.	Improbable source.	Improbable source.	Poor: thin layer.	Not needed	Droughty; rooting depth.	Depth to rock; large stones; rooting depth.
Severe: seepage.	Moderate: piping; erodes easily.	Good	Fair: excess fines.	Improbable source.	Poor: too sandy.	Not needed	Droughty; seepage.	Erodes easily; too sandy.
Severe: seepage.	Severe: seepage.	Good	Improbable source.	Good	Poor: small stones.	Not needed	Droughty; rooting depth; seepage; slope.	Depth to rock; rooting depth; slope.

TABLE 10.—*Interpretations of engineering*

Soil series and map symbols	Degree and kind of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill	Local roads and streets
Quihi: QgC	Severe: depth to rock; percs slowly.	Severe: depth to rock.[1]	Moderate: depth to rock.	Moderate: shrink-swell.	Severe: too clayey.[1]	Moderate: shrink-swell.
Seguin: Se	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Sunev: SuA, SuB, SuC3	Slight	Severe: seepage.	Slight	Slight	Slight	Moderate: low strength.
Trinity: Tr, Tw	Severe: floods; percs slowly.	Severe: floods.	Severe: floods; too clayey.	Severe: floods; shrink-swell.	Severe: floods.	Severe: floods; shrink-swell.
Uhland: Uh, Uw	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Vernia: VrC	Slight	Moderate: seepage.	Severe: small stones.	Slight	Severe: small stones.	Slight
Windthorst: WdB, WdC3	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey; wet.	Severe: low strength; shrink-swell.	Moderate: too clayey.	Severe: low strength; shrink-swell.

[1] May pollute water supplies.
[2] Beds of limestone gravel and sand below a depth of 6 feet in some places.

ular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 10 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 or 15 feet, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 10, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade or underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil material at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Road fill is soil material used in embankments for

properties of the soils—Continued

Degree and kind of limitation for—continued		Suitability as a source of—				Soil features affecting—		
Pond reservoir areas	Dikes, levees, and other embankments	Road fill	Sand	Gravel	Topsoil	Drainage for crops and pastures	Irrigation	Terraces and diversions
Severe: depth to rock.	Severe: piping; thin layer.	Poor: thin layer.	Improbable source.	Good	Poor: small stones.	Not needed	Droughty; rooting depth; seepage.	Depth to rock; piping; rooting depth.
Severe: seepage.	Moderate: compressible; piping.	Severe: low strength.	Improbable source.	Improbable source.	Poor: excess lime.	Floods	Floods	Not needed.
Severe: seepage.	Moderate: compressible; piping.	Fair: low strength.	Improbable source.	Improbable source.[2]	Poor: excess lime.	Good	Excess lime; seepage.	Not needed.
Slight	Moderate: compressible; shrink-swell.	Poor: shrink-swell.	Improbable source.	Improbable source.	Poor: too clayey.	Floods; percs slowly; wet.	Floods; percs slowly.	Not needed.
Moderate: seepage.	Moderate: piping.	Fair: wet	Improbable source.	Improbable source.	Fair: too clayey.	Floods; wet	Floods; wet	Not needed.
Moderate: seepage.	Moderate: hard to pack; seepage.	Good	Poor: excess fines.	Fair: excess fines.	Poor: small stones; too sandy.	Not needed	Droughty; seepage.	Too sandy.
Moderate: seepage.	Moderate: compressible; shrink-swell.	Fair: low strength; shrink-swell.	Improbable source.	Improbable source.	Fair: thin layer.	Not needed	Percs slowly; slope.	Favorable.

roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Drainage of cropland and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope, stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in claypans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared

TABLE 11.—*Engineering*

[Absence of data indicates that no determination was made. Tests performed by

Soil name and location	Parent material	Report No.	Depth	Shrinkage			Percent of liquid limit volume
				Limit	Linear	Ratio	
			Inches				
Altoga silty clay: 8 miles west of Seguin on Farm Road 78, 7 miles north on Farm Road 1044, then 500 feet into pasture west of road. (Modal)	Silty clay of Taylor Marl Formation.	68–360–R	0–7	17	10.9	1.80	29.3
		68–361–R	7–20	20	9.9	1.70	24.9
		68–362–R	20–32	18	11.5	1.79	30.7
		68–363–R	32–72	15	13.5	1.92	39.7
Arenosa fine sand: 8 miles southeast of Seguin on Farm Road 466, 4 miles south on Farm Road 2770, then 100 feet into woods west of road. (Modal)	Sand of the Carrizo Formation.	68–354–R	0–10	16	0.1	1.82	0.3
		68–355–R	10–48	16	0	1.83	0
		68–356–R	48–96	15	0	1.83	0
Austin silty clay: 7 miles north of Cibolo on Farm Road 1103, 3.5 miles west on Interstate Highway 35, then 600 feet into field south of road. (Modal)	Austin Chalk.	68–556–R	0–18	15	15.0	1.94	38.6
		68–557–R	18–28	17	12.0	1.82	31.9
		68–558–R	28–42	22	7.3	1.65	20.3
Barbarosa silty clay: 2 miles northwest of Seguin on Texas Highway 25, 1 mile east on gravel road, then 300 feet into field south of road. (Modal)	Clayey alluvium of Guadalupe River.	68–564–R	0–24	16	18.3	1.92	46.3
		68–565–R	24–48	14	19.0	1.94	46.9
		68–566–R	48–60	16	17.8	1.93	44.5
Branyon clay: 2.5 miles west of Geronimo on paved road to Friedens Church, 0.25 mile south on paved road, then 400 feet into pasture west of road. (Modal)	Ancient clayey alluvium of the Guadalupe River.	70–385–R	0–58	13	22.3	1.99	----------
		70–386–R	58–64	11	23.7	2.04	----------
		70–387–R	64–76	13	15.0	2.01	----------
Crockett fine sandy loam: 3 miles north of Seguin on Texas Highway 123, 2 miles east on Farm Road 20, 1.5 miles east on gravel road, then 0.5 mile into pasture east of road. (Modal)	Interbedded sand and clay of the Wilcox Formation.	69–26–R	0–8	18	6.7	1.77	----------
		69–27–R	8–22	14	12.5	1.90	----------
		69–28–R	22–34	13	15.5	1.96	----------
		69–29–R	40–60	16	13.2	1.84	----------
Demona loamy fine sand: 10 miles east of Seguin on U.S. Highway 90–A, 1 mile north on paved road, 1 mile north on gravel road, then 100 feet into brushy pasture northeast of road. (Modal)	Interbedded sand and clay of the Wilcox Formation.	68–559–R	0–12	19	1.5	1.69	4.4
		68–560–R	12–22	18	0.1	1.75	0
		68–561–R	22–38	14	20.1	2.00	49.0
		68–562–R	38–50	14	18.4	1.95	45.7
		68–563–R	50–62	16	16.8	1.86	42.4
Lewisville silty clay: 20 miles west of Seguin on Farm Road 78 to Schertz, 1.5 miles north on Farm Road 1518, 0.5 mile east on gravel road, then 100 feet into field north of road. (Modal)	Clayey and loamy alluvium of Cibolo Creek.	68–364–R	0–12	18	13.3	1.88	34.8
		68–365–R	12–26	15	14.8	1.93	38.2
		68–366–R	26–38	15	14.8	1.94	38.2
		68–367–R	38–60	16	10.9	1.86	29.3
Mabank loam: 3 miles north of Seguin on Texas Highway 123, 2 miles east on Farm Road 20, 1 mile east on gravel road, then 150 feet into pasture south of road. (Modal)	Calcareous clay of the Wilcox Formation.	69–22–R	0–10	15	5.0	1.84	----------
		69–24–R	24–40	12	17.3	1.99	----------
		69–25–R	40–60	12	17.7	2.04	----------

test data

Texas Highway Department, Materials and Testing Division, Camp Hubbard, Austin]

Mechanical analysis [1]												Liquid limit	Plasticity index	Classification	
Percentage passing sieve—									Percentage smaller than—						
2 in	1¼ in	⅞ in	⅝ in	⅜ in	No. 4 (4.0 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm			AASHTO [2]	Unified [3]
												Percent			
					100	99	98	95	90	66	46	40	20	A–6(12)	CL
								99	97	60	39	42	21	A–7–6(12)	CL
								99	97	60	41	43	24	A–7–6(14)	CL
								99	97	64	43	44	27	A–7–6(15)	CL
						100	71	13	9	3	0	19	3	A–2–4(0)	SM
						100	72	12	8	4	1	19	2	A–2–4(0)	SM–SP
	100	98	98	98	97	97	63	13	10	4	2	16	1	A–2–4(0)	SM
						100	98	92	88	59	45	48	29	A–7–6(17)	CL
					100	99	98	93	89	61	49	45	23	A–7–6(14)	CL
					100	99	98	89	83	54	36	40	18	A–6(11)	CL
							100	90	85	51	44	59	29	A–7–6 or A–7–5(19)	CH–MH
					100	99	98	88	83	63	56	60	34	A–7–6(20)	CH
			100	97	88	79	75	67	64	49	40	57	32	A–7–6(17)	CH
						100	99	93	90	61	51	70	47	A–7–6(20)	CH
				100	99	97	95	91	88	59	51	73	50	A–7–6(20)	CH
				100	99	98	96	88	84	55	33	44	29	A–7–6(16)	CL
			100	99	99	99	98	83	70	26	23	31	15	A–6(10)	CL
					100	99	98	87	77	40	36	40	23	A–6(13)	CL
				100	99	98	97	89	83	45	40	47	29	A–7–6(17)	CL
			100	99	97	94	91	85	81	35	30	45	27	A–7–6(16)	CL
				100	99	99	98	30	21	7	3	22	4	A–2–4(0)	SM–SC
				100	99	98	87	29	19	5	2	19	3	A–2–4(0)	SM
				100	99	98	97	80	77	55	51	62	42	A–7–6(20)	CH
					100	99	99	81	76	51	48	56	39	A–7–6(19)	CH
								83	73	45	39	55	38	A–7–6(19)	CH
					100	99	98	89	80	35	24	46	22	A–7–6(14)	CL
						100	99	92	87	52	41	48	25	A–7–6(16)	CL
					100	99	98	91	83	53	43	47	25	A–7–6(15)	CL
			100	96	90	88	84	73	68	45	32	38	21	A–6(12)	CL
	100	99	98	97	97	97	96	65	53	18	16	24	9	A–4(6)	CL
					100	99	98	77	71	46	41	51	34	A–7–6(18)	CH
				100	99	97	95	76	70	46	40	50	35	A–7–6(18)	CL–CH

TABLE 11.—*Engineering*

Soil name and location	Parent material	Report No.	Depth	Shrinkage			Percent of liquid limit volume
				Limit	Linear	Ratio	
			Inches				
Queeny loam:							
1.5 miles east of Seguin on U.S. Highway 90–A, 0.2 mile south on paved road, then 400 feet west of road to west side of gravel pit. (Modal)	Loamy and gravelly alluvium of the Guadalupe River.	70–79–R	0–7	18	8.5	1.79	----------
		70–80–R	7–144	17	4.8	1.84	----------
Seguin silty clay loam:							
500 feet east of Texas Highway 123 on north side of Guadalupe River bridge in Seguin. (Modal)	Loamy alluvium of Guadalupe River.	69–30–R	0–13	21	8.3	1.72	----------
		69–31–R	13–60	23	8.2	1.70	----------
Sunev loam:							
5 miles northwest of McQueeny on Farm Road 725, 1 mile northeast on gravel road, then 300 feet into field south of road. (Modal)	Loamy alluvium of Guadalupe River.	68–567–R	0–11	17	5.1	1.85	14.5
		68–568–R	11–21	17	7.2	1.85	20.1
		68–569–R	21–60	17	5.5	1.82	15.6
Windthorst fine sandy loam:							
7 miles south of Seguin on Texas Highway 123, 2 miles east on paved road, then 50 feet into pasture south of road. (Modal)	Interbedded sand and clay of the Wilcox Formation.	68–349–R	0–8	20	0.7	1.67	2.1
		68–350–R	8–19	16	16.3	1.85	41.2
		68–351–R	19–36	17	14.3	1.82	37.1
		68–352–R	36–48	20	7.7	1.74	21.4

[1] Mechanical analysis according to the AASHTO Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the Soil Survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-sized fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-sized fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and does not require excessive management to produce a cover of plants.

Engineering Test Data

Table 11 contains engineering test data for some of the major soil series in Guadalupe County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed maximum dry density. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when oven-dry.

Linear shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material, as has been explained for table 9.

Formation and Classification of the Soils

In this section the factors of soil formation and the classification of the soils are described.

test data—Continued

Mechanical analysis [1]												Liquid limit	Plasticity index	Classification	
Percentage passing sieve—									Percentage smaller than—						
2 in	1¼ in	⅞ in	⅝ in	⅜ in	No. 4 (4.0 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm			AASHTO [2]	Unified [3]
												Percent			
100	93	89	87	85	84	83	81	44	37	18	15	36	16	A-6(4)	SC
100	98	87	67	47	29	22	14	7	7	4	3	26	12	A-2-6(0)	GW-GC
------	------	------	------	------	--------	100	99	88	82	33	25	38	19	A-6(12)	CL
------	------	------	------	------	--------	--------	--------	96	93	40	29	40	19	A-6(12)	CL
------	------	------	------	------	--------	100	97	52	47	23	18	26	11	A-6(4)	CL
------	------	------	------	------	100	99	96	59	55	34	26	31	16	A-6(7)	CL
------	------	------	100	99	97	95	90	56	49	32	22	27	13	A-6(5)	CL
------	------	------	100	99	96	92	89	21	14	4	3	21	2	A-2-4(0)	SM
------	------	------	------	------	100	99	99	70	66	59	56	55	31	A-7-6(18)	CH
------	------	------	------	------	100	99	98	64	59	51	48	50	27	A-7-6(14)	CL-CH
------	100	99	99	98	96	95	94	39	35	27	24	35	21	A-6(4)	SC

[2] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 10): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M-145-49.

[3] Based on the Unified soil classification system.

Factors of Soil Formation

The five major factors of soil formation are the climate under which the soil material accumulated and weathered; the living organisms on and in the soil; the composition of the parent material; the topography, or lay of the land; and the length of time the forces of soil formation have acted on the soil material. The relative importance of each factor differs from place to place, and each modifies the effect of the other four. In some cases one factor may dominate in formation of a soil.

Climate and living organisms, chiefly vegetation, are the active factors of soil formation. They alter the accumulated soil material and bring about the formation of genetically related horizons. Topography, mainly by its influence on temperature and runoff, modifies the effect of climate and vegetation. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. Generally, a long time is required for the development of distinct horizons.

Climate

The climate of Guadalupe County is a humid subtropical type characterized by hot summers and continental winters. Precipitation is well distributed throughout the year, and peak rainfall occurs late in spring and early in fall. Evaporation is high, and rainfall seldom wets the soil below the root zone. Rainfall is sufficient to leach some of the lime from the upper horizons of soils such as Altoga and Lewisville, but not enough to leach it entirely from the soil. Consequently, many of the soils have a layer in which lime has accumulated. Other soils, such as Crockett and Mabank soils, have been leached and fine clay particles have moved down in the profile and accumulated to form a dense, very slowly permeable horizon.

Wind has been a minor factor in the formation of the Arenosa and Patilo soils. It has contributed to weathering of the parent materials, has reworked some deposits, and has shifted material from place to place.

Living organisms

The living organisms on and in the soils are plants and animals of various sizes. The plants that live in the soil range from trees to bacteria, fungi, or other microscopic plants. In the blackland prairie in the northern part of the county, tall prairie grasses had more influence than other plants on soil formation. These tall grasses provided litter that protected the surface and added organic-matter content to the soil. Their roots reached deep into the soil and took up

minerals at lower depths. When the grasses died, large amounts of these minerals were left near the surface. Lime, or other minerals, and organic matter were distributed through the soil profile as these plants died and decomposed and were replaced by new plants. When the roots of plants decomposed, they left channels that increased the intake of water and the aeration of the soil. Earthworms and other soil organisms feed on the decomposed roots. The borings of earthworms also help to channel water and air through the soil. In the sandy areas in the southern part of the county, an open savannah of tall grasses and hardwoods influenced soil formation. Soils in this area tend to be slightly acid, and low in content of organic matter.

The processes of soil formation were well balanced under natural conditions before man began using the soils. Vegetation covered the soils, and soil-forming processes were active. But these processes have been disturbed where man has misused the soil by clean tilling and by permitting overgrazing. The native vegetation has been destroyed, and accelerated erosion has removed much of the surface layer of many soils. On many fields used mainly for row crops, the activity of micro-organisms and earthworms has been reduced greatly in the surface layer.

Parent material

The soils of Guadalupe County formed in material from three geological periods. These are the Upper Cretaceous, Tertiary, and Quaternary.

In the Upper Cretaceous period are the Austin Chalk, Anacacho Limestone, Taylor Marl, and Navarro formations. The blackland prairie soils in the northern part of the county formed from chalk, soft limestone, marl, clay, and shale of the formations. They are mainly moderately deep to deep, dark silty clays and clays of the Austin, Heiden, and Houston Black series.

In the Tertiary period are the Midway, Wilcox, Carrizo, Reklaw, and Queen City formations. The soils of the mesquite belt in the central part of the county formed from clay, silt, sand, sandstone, and sandy shale of the Midway and Wilcox formations. They are mainly deep soils that have a sandy or loamy surface layer underlain by dense clayey lower layers. The principal soils are in the Crockett, Demona, and Windthorst series. The sandy soils of the oak and hickory belt in the southern part of the county formed from sand, sandstone, silt, clay, and shale of the Carrizo, Reklaw, and Queen City formations. They are mainly deep sands of the Patilo and Arenosa series.

In the Quaternary period are the Leona and Alluvium formations. The soils of the broad flat terraces and flood plains of the Guadalupe River, San Marcos River, Cibolo Creek, Santa Clara Creek, and Geronimo Creek formed from stratified clay, silt, sand, and gravel of these formations. Soils formed from the Leona formation are mainly deep, dark clays and silty clays of the Branyon, Barbarosa, and Lewisville series. Soils formed from the Alluvium formation are deep, dark loams, silty clay loams, and clays of the Seguin, Bosque, Sunev, and Trinity series.

Relief

Relief, or the lay of the land, influences soil formation through its effect on drainage and runoff. If other factors of soil formation are equal, the degree of profile formation depends mainly upon the average amount of moisture in the soil. Steep soils absorb less moisture and most have less distinct profiles than gently sloping or nearly level soils. Some steep soils have so much runoff that geologic erosion almost keeps pace with the weathering of rocks and the formation of soils. Conversely, more nearly level soils absorb more water that falls and are less likely to erode. Depressions or concave areas receive extra water through runoff from adjacent soils, and in these areas the soils can be wet for long periods. The wetness affects the rate of horizon formation.

Thus, through the general influence of runoff and drainage, relief inhibits some processes of horizon differentiation and hastens others. Soils that form from the same kind of parent material but in different positions within the landscape are likely to have dissimilar profiles.

The distinctness of horizons within a soil profile and the total thickness of the solum are closely related to relief. Ordinarily soils that have a thick solum and less distinct horizons are gently sloping. Steeper soils have a thinner solum and less distinct horizons. Except for sandy soils, which are permeable and generally well drained, level or nearly level soils are likely to be dense, less permeable, and have poorer drainage.

Some soils in the blackland prairie in the northern part of the county, such as Houston Black, Branyon, and Burleson soils, have a gilgai micro-relief of low circular knolls and depressed areas between. The knolls and depressions are the result of the shrinking and swelling of the clay. When these soils dry, the clay particles shrink, pull apart, and leave wide, deep cracks. When moisture is available, the cracks fill with water. The heavy clay in the lower layers absorbs the water and swells. It then buckles upward in an uneven, wavy pattern and forms the small knolls.

Time

Time is required for the formation of a mature soil from parent material. Some materials that have been in place for only a short time have not been influenced enough by climate, relief, and living organisms to have formed well-defined, genetically related horizons. Such soils on bottom land as the Bosque and Seguin are examples of soils that have weakly formed profiles.

Some deep soils that have indistinct horizons are considered young and poorly formed. Sunev soils are examples.

Steeper soils have less formation because geologic erosion resulting from relief has overcome the influence of other soil-forming factors. Ferris and Nebgen soils are examples of these. Soils that have been in place for a long time and have approached equilibrium with their environment are considered mature soils. These soils show marked horizon differentiation. Crockett, Mabank, and Windthorst soils are examples.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole

environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms and fields; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.[6]

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 12 the soil series of Guadalupe County are placed in 4 categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates.

Alfisols have a light-colored surface layer low in organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent. Entisols have little or no evidence of formation of pedogenic horizons. Inceptisols have a light-colored surface layer low in content of organic matter, but they lack a clay-enriched B horizon. Mollisols have a dark-colored surface layer high in content of organic matter, and they have a base saturation of more than 50 percent. Vertisols are clayey soils that have deep, wide cracks for part of the year in most years.

SUBORDER. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation.

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and those that have thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like.

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reactions, soil temperature, permeability, thickness of horizons, and consistence.

General Nature of the County

This section provides information about the climate, physiography and drainage, and ground water supply of Guadalupe County.

Climate[7]

The climate of Guadalupe County, well represented by the weather station at Seguin, is a humid subtropical type characterized by hot summers. Tropical maritime air masses predominate throughout spring, summer, and fall. Modified polar air masses exert considerable influence during winter and provide a continental type of climate, characterized by considerable variations in temperature. Mean annual total precipitation is 30.23 inches. Peak rainfall, the result of thundershowers, is in late spring. A secondary peak occurs in early fall. A total of 49.47 inches fell in 1949, the wettest year on record, while only 15.00 inches fell in 1925, the driest year. The prevailing winds are southeasterly March through September and northerly October through February. Seguin receives about 62 percent of the total possible sunshine annually. The mean annual relative humidity is 83 percent at 6:00 a.m., 55 percent at noon, and 53 percent at 6:00 p.m., Central Standard Time. Table 13 gives a summary of the climate for Guadalupe County.

Winter is not marked by any prolonged periods of cold weather but rather by short spans of 36 to 72 hours. The winter season is one of many changes. The weather fluctuates between warm and cold, clear and cloudy, wet and dry, as a wide assortment of air masses moves in and out of the area. Normally, daytime temperatures are sufficiently mild and cause little or no interference with outdoor work or recreation. Minimum temperatures of 32° F or below occur only about 22 percent of the time. Most winter precipitation occurs as light rain or drizzle. Considerable cloudiness generally persists through the morning, dissipating by

[6] United States Department of Agriculture. 1960. Soil classification, a comprehensive system, 7th approximation. 265 pp., illus. (Supplements issued in March 1967 and September 1968)

[7] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Dept. of Commerce.

TABLE 12.—*Soil series classified by higher categories*

Series	Family	Subgroup	Order
Altoga	Fine-silty, carbonatic, thermic	Typic Ustochrepts	Inceptisols.
Arenosa	Thermic, coated	Typic Quartzipsamments	Entisols.
Austin	Fine-silty, carbonatic, thermic	Typic Haplustolls (Calciustolls)	Mollisols.
Barbarosa	Fine, montmorillonitic, thermic	Udertic Paleustolls	Mollisols.
Bosque	Fine-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Branyon	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Burleson	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Crockett	Fine, montmorillonitic, thermic	Udertic Paleustalfs	Alfisols.
Darst	Fine, mixed, thermic	Ultic Paleustalfs	Alfisols.
Demona	Clayey, mixed, thermic	Aquic Arenic Paleustalfs	Alfisols.
Doss	Loamy, carbonatic, thermic, shallow	Typic Calciustolls	Mollisols.
Eddy	Loamy-skeletal, carbonatic, thermic, shallow	Typic Ustorthents	Entisols.
Ferris	Fine, montmorillonitic, thermic	Udorthentic Chromusterts	Vertisols.
Heiden	Fine, montmorillonitic, thermic	Udic Chromusterts	Vertisols.
Houston Black	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Jedd	Fine, mixed, thermic	Ultic Paleustalfs	Alfisols.
Lewisville	Fine-silty, mixed, thermic	Typic Calciustolls	Mollisols.
Mabank	Fine, montmorillonitic, thermic	Vertic Albaqualfs	Alfisols.
Nebgen	Loamy, mixed, nonacid, thermic, shallow	Typic Ustorthents	Entisols.
Patilo	Loamy, siliceous, thermic	Grossarenic Paleustalfs	Alfisols.
Queeny	Loamy, mixed, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Quihi [1]	Clayey-skeletal, mixed, hyperthermic	Petrocalcic Paleustolls	Mollisols.
Seguin	Fine-silty, carbonatic, thermic	Fluventic Haplustolls	Mollisols.
Sunev	Fine-loamy, carbonatic, thermic	Typic Calciustolls	Mollisols.
Trinity	Fine, montmorillonitic (calcareous), thermic	Vertic Haplaquolls	Mollisols.
Uhland	Coarse-loamy, mixed, nonacid, thermic	Aquic Ustifluvents	Entisols.
Vernia	Loamy-skeletal, mixed, thermic	Grossarenic Paleustalfs	Alfisols.
Windthorst	Fine, mixed, thermic	Udic Paleustalfs	Alfisols.

[1] The Quihi soils mapped in Guadalupe County are in the thermic soil temperature family (69° F), but the Quihi series is classified in the hyperthermic soil temperature family. The Quihi soils in Guadalupe County are within the 2-degree allowable range in soil temperature and are not considered to be taxadjuncts. Use, vegetation, and management are similar to those of the Quihi series.

TABLE 13.—*Temperature and*

[Data from Seguin, elevation 505 feet. Period of

Month	Temperature				Precipitation				
	Mean daily maximum	Mean monthly highest maximum	Mean daily minimum	Mean monthly lowest minimum	Mean total	Probability, in percent, of receiving selected amounts during month			
						0 or trace	.5 inch or more	1.0 inch or more	2.0 inches or more
	°F	°F	°F	°F	*Inches*				
January	63.0	80.9	39.8	20.9	1.80	<1	82	65	40
February	67.1	83.3	43.4	26.5	2.36	<1	90	70	40
March	74.6	89.3	49.0	30.8	1.74	<1	85	70	40
April	81.3	92.0	58.0	40.3	3.28	<1	94	80	60
May	87.0	95.2	64.9	51.1	3.35	<1	98	90	71
June	92.8	98.5	70.6	61.5	3.07	<1	92	78	58
July	96.0	101.2	72.3	67.1	1.76	1	85	70	47
August	96.6	102.1	71.9	65.1	2.20	4	81	68	43
September	90.6	99.1	67.5	54.5	3.99	<1	90	80	59
October	83.3	93.2	58.3	41.7	3.32	3	77	77	47
November	72.4	86.8	47.8	30.3	2.24	<1	81	60	30
December	66.0	81.3	41.9	25.4	1.77	<1	90	75	48
Year	80.9		57.1		30.88				

[1] Length of record, 16 years.

[2] Trace.

noon, with clear to partly cloudy skies a high percentage of the time during the afternoon.

Spring is a very pleasant season. March is a dry month. Warm and cool spells of short duration follow each other in rapid succession. Thundershowers increase in April and peak in May. Considerable early morning cloudiness continues but clouds dissipate earlier than in winter.

Summer temperatures are hot in the daytime. Daily maxima reach or exceed 90° F almost every day. Heavy thundershowers continue into June, but July and August are hot and dry with little variation in the weather regime from day to day. Refrigerated air-conditioning is recommended for maximum comfort indoors or in an automobile.

Fall is warm through September and precipitation increases during that month. The fall weather has greater variety than the summer weather. Daytime temperatures in October and November are pleasantly mild while nights are crisp and cool. This is the most delightful season of the year with long periods of uninterrupted fair weather and light winds.

The mean length of the growing season (freeze-free period) in Seguin is 267 days. The mean dates of the last 32° F freeze in spring and the first 32° F freeze in fall are March 6 and November 28, respectively. Because of differences in topography, soil types and condition, exposure, and vegetative cover, significant departures from these mean values are likely to be observed not only in the surrounding rural area but in Seguin as well. The mean annual lake evaporation is estimated at 56 inches.

Physiography and Drainage

Guadalupe County is in the west Gulf Coastal Plain of Texas. The county is divided into two northeastward-trending belts which are marked by soil, plant, and topographic characteristics.

The blackland prairie belt is in the northwestern third of the county. Most soils are gently sloping to sloping and were influenced by the weathering of mainly clayey, dark material.

The post oak belt occupies most of the rest of the county. In this belt, the surface slopes southeastward, and soils are sandier and timbered.

Altitude in the county ranges from about 900 feet a few miles north of Schertz to about 300 feet in the Guadalupe River channel where the river leaves the county.

Most of the county is in the drainage basin of the Guadalupe River, but the western fourth of the county is in the San Antonio River Basin. Cibolo Creek, a tributary of the San Antonio River, drains an area adjacent to Bexar and Wilson Counties. The Guadalupe River enters the county northwest of Seguin, flows southeastward through Seguin, and thence eastward into Gonzales County. The northeastern part of the county is drained by the San Marcos River, a tributary of the Guadalupe River.

Ground Water

The principal water-bearing units underlying Guadalupe County are the Edwards Limestone formation and

precipitation data

record 1938–71. The symbol < means less than]

Precipitation—continued									
Probability, in percent, of receiving selected amounts during month—continued				Mean number of days [1]—			Snow, sleet		
3.0 inches or more	4.0 inches or more	5.0 inches or more	6.0 inches or more	.1 inch or more	.5 inch or more	1.0 inch or more	Mean total	Maximum monthly	Greatest depth [1]
							Inches		
23	8	5	3	3	1	1	0.2	3.0	([2])
20	10	5	3	6	2	1	0.3	3.5	([2])
21	11	5	3	3	1	([3])	([2])	([2])	0
40	25	17	10	3	2	1	0.0	0.0	0
50	35	24	16	4	2	1	0.0	0.0	0
40	25	18	13	3	1	1	0.0	0.0	0
28	17	8	7	2	1	1	0.0	0.0	0
30	17	10	10	3	1	1	0.0	0.0	0
45	35	25	17	5	2	1	0.0	0.0	0
31	22	17	11	4	3	1	0.0	0.0	0
17	8	5	2	4	1	1	([3])	0.8	1
25	11	5	3	4	1	([3])	([2])	([2])	0
				44	18	10	0.5	3.5	1

[3] Less than one-half day.

associated limestones, Austin Chalk formation, Wilcox group, Carrizo Sand formation, Leona formation, and alluvium. The Wilcox group and the Carrizo Sand formation together constitute the most favorable aquifer for large-scale ground water development. The location of the water-bearing units can be determined from the General Soil Map in this soil survey. The Wilcox group underlies the Crockett-Demona-Windthorst association, Carrizo Sand underlies the Patilo-Arenosa association, Austin Chalk formation underlies the Austin-Eddy association, and alluvium and the Leona formation underlie the Seguin-Sunev and Branyon-Barbarosa-Lewisville associations. The Edwards Limestone formation and associated limestones are mainly in the northwest part of the county.

Yields of water wells range from a few gallons per minute to as much as 2,000 gallons per minute. The largest yields are from wells in the Wilcox group. Potentially larger yields generally can be expected from properly constructed wells tapping both the Carrizo Sand formation and the Wilcox group.

The chemical quality of the water from the several aquifers differs widely. The Wilcox group contains fresh to slightly saline water throughout a large part of its extent in the county. It is also hard to very hard and has a high content of iron. The water from the Carrizo Sand formation is soft to very hard. It generally is low in sulfate and chloride, high in iron, and it is acidic. The alluvium and Leona formation furnish water for most purposes, but the hardness and high concentration of nitrate render the water less desirable for public supply or domestic use. The Edwards Limestone formation and associated limestone yield water that commonly contains objectionable quantities of hydrogen sulfide.

Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Compressible. The soil is relatively soft and decreases excessively in volume when a load is applied.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Cutbanks cave. Walls of cuts are not stable. The soil sloughs easily.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Depth to rock. Bedrock is so near the surface that it affects specified use of the soil.

Excess fines. The soil contains too much silt and clay for use as gravel or sand in construction.

Excess lime. The amount of carbonates in the soil is so high that it restricts the growth of some plants.

Fast intake. Water infiltrates rapidly into the soil.

Favorable. Features of the soil are favorable for the intended use.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Large stones. Rock fragments 10 inches or more across affect the specified use.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Low strength. The soil has inadequate strength to support loads.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Percs slowly. Water moves through the soil slowly, affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Piping. The soil is susceptible to the formation of tunnels or pipelike cavities by moving water.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind of climax vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth. A layer that greatly restricts the downward rooting of plants occurs at a shallow depth.

Seepage. Water moves through the soil so quickly that it affects the specified use.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shrink-swell. The soil expands on wetting and shrinks on drying, which may cause damage to roads, dams, building foundations, or other structures.

Silica. Silica is a combination of silicon and oxygen. The mineral form is called quartz.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Small stones. Rock fragments that are less than 10 inches across may affect the specified use.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.005 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principle forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles) adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the

soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Thin layer. Suitable soil material is not thick enough for use as borrow material or topsoil.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Unstable fill. Banks of fill are likely to cave in or slough.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

GUIDE TO MAPPING UNITS

For complete information about a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. When referring to a capability unit or range site, read the introduction to its section for general information about its management.

Map symbol	Mapping unit	Page	Capability unit		Range site		Gardening and landscaping group
			Symbol	Page	Name		Number
AlC3	Altoga silty clay, 3 to 5 percent slopes, eroded	8	IIIe-2	37	Clay Loam		2
AlE3	Altoga silty clay, 5 to 12 percent slopes, eroded	8	VIe-1	40	Clay Loam		2
ArD	Arenosa fine sand, 1 to 8 percent slopes	9	IVs-1	39	Deep Sand Savannah		1
AuB	Austin silty clay, 1 to 3 percent slopes	9	IIIe-2	37	Clay Loam		2
AuC3	Austin silty clay, 3 to 5 percent slopes, eroded	10	IVe-1	39	Clay Loam		2
BaA	Barbarosa silty clay, 0 to 1 percent slopes	10	IIs-1	37	Clay Loam		2
BaB	Barbarosa silty clay, 1 to 3 percent slopes	11	IIe-2	36	Clay Loam		2
Bo	Bosque and Sequin soils, frequently flooded	11	Vw-1	40	Loamy Bottomland		2
BrA	Branyon clay, 0 to 1 percent slopes	12	IIw-1	36	Blackland		4
BrB	Branyon clay, 1 to 3 percent slopes	12	IIe-1	35	Blackland		4
BuA	Burleson clay, 0 to 1 percent slopes	14	IIw-1	36	Blackland		4
ByA	Burleson gravelly clay, 0 to 1 percent slopes	14	IIw-1	36	Blackland		4
ByB	Burleson gravelly clay, 1 to 3 percent slopes	14	IIe-1	35	Blackland		4
CfA	Crockett fine sandy loam, 0 to 1 percent slopes	15	IIIs-1	38	Claypan Prairie		3
CfB	Crockett fine sandy loam, 1 to 3 percent slopes	15	IIIe-3	37	Claypan Prairie		3
CgC	Crockett gravelly sandy loam, 1 to 5 percent slopes	15	IVe-2	39	Claypan Prairie		3
CsC3	Crockett loam, 2 to 5 percent slopes, eroded	15	IVe-2	39	Claypan Prairie		3
CsD4	Crockett loam, 3 to 8 percent slopes, severely eroded	15	VIe-1	40	Claypan Prairie		3
DgE	Darst very gravelly sandy loam, 5 to 10 percent slopes	16	VIe-2	40	Sandy Loam		6
DmC	Demona loamy fine sand, 1 to 5 percent slopes	17	IIIe-4	38	Sandy		1
DoB	Doss silty clay, 1 to 3 percent slopes	18	IIIe-5	38	Chalky Ridge		5
EgC	Eddy gravelly clay loam, 3 to 5 percent slopes	18	VIe-3	40	Chalky Ridge		5
FhF3	Ferris and Heiden soils, 5 to 20 percent slopes, eroded	19	VIe-1	40	Eroded Blackland		4
HeB	Heiden clay, 1 to 3 percent slopes	20	IIe-1	35	Blackland		4
HeC	Heiden clay, 3 to 5 percent slopes	20	IIIe-1	37	Blackland		4
HeC3	Heiden clay, 3 to 5 percent slopes, eroded	20	IIIe-1	37	Blackland		4
HeD3	Heiden clay, 5 to 8 percent slopes, eroded	20	IVe-3	39	Blackland		4
HoA	Houston Black clay, 0 to 1 percent slopes	22	IIw-1	36	Blackland		4
HoB	Houston Black clay, 1 to 3 percent slopes	22	IIe-1	35	Blackland		4
HpB	Houston Black gravelly clay, 1 to 3 percent slopes	22	IIe-1	35	Blackland		4
HpC	Houston Black gravelly clay, 3 to 5 percent slopes	22	IIIe-1	37	Blackland		4
LeA	Lewisville silty clay, 0 to 1 percent slopes	23	I-1	35	Clay Loam		2
LeB	Lewisville silty clay, 1 to 3 percent slopes	24	IIe-2	36	Clay Loam		2
MaA	Mabank loam, 0 to 1 percent slopes	24	IIIw-1	38	Claypan Prairie		3
MaB	Mabank loam, 1 to 3 percent slopes	24	IIIe-3	37	Claypan Prairie		3
MaB3	Mabank loam, 1 to 3 percent slopes, eroded	24	IVe-2	39	Claypan Prairie		3
NcF	Nebgen-Jedd complex, 3 to 20 percent slopes	25	VIIs-1	41	Sandstone Hills		6
PaD	Patilo and Arenosa soils, 1 to 8 percent slopes	26	IVs-1	39	Deep Sand Savannah		1
QeC	Queeny gravelly loam, 1 to 5 percent slopes	27	IVs-2	40	Chalky Ridge		5
QeF	Queeny gravelly loam, 5 to 20 percent slopes	27	VIs-1	40	Chalky Ridge		5

Map symbol	Mapping unit	Page	Capability unit		Range site		Gardening and landscaping group
			Symbol	Page	Name		Number
QgC	Quihi soils, 1 to 5 percent slopes	28	IVs-2	40	Chalky Ridge		5
Se	Seguin silty clay loam	29	I-1	35	Loamy Bottomland		2
SuA	Sunev loam, 0 to 1 percent slopes	31	IIs-1	37	Clay Loam		2
SuB	Sunev loam, 1 to 3 percent slopes	31	IIe-2	36	Clay Loam		2
SuC3	Sunev loam, 3 to 5 percent slopes, eroded	31	IIIe-2	37	Clay Loam		2
Tr	Trinity clay	31	IIw-1	36	Clayey Bottomland		4
Tw	Trinity clay, frequently flooded	32	Vw-1	40	Clayey Bottomland		4
Uh	Uhland fine sandy loam, occasionally flooded	32	IIw-2	36	Loamy Bottomland		3
Uw	Uhland soils, frequently flooded	32	Vw-1	40	Loamy Bottomland		3
VrC	Vernia very gravelly loamy sand, 1 to 5 percent slopes	33	IVs-1	39	Very Gravelly		1
WdB	Windthorst fine sandy loam, 1 to 3 percent slopes	34	IIe-3	36	Sandy Loam		3
WdC3	Windthorst fine sandy loam, 1 to 5 percent slopes, eroded	34	IIIe-3	37	Sandy Loam		3

☆ U.S. GOVERNMENT PRINTING OFFICE: 1977—227-032/25

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

SOIL ASSOCIATIONS

1 Crockett-Demona-Windthorst association: Deep, moderately well drained, gently sloping to sloping, loamy to sandy soils on uplands

2 Branyon-Barbarosa-Lewisville association: Deep, moderately well drained to well drained, nearly level to gently sloping, clayey soils on stream terraces

3 Houston Black-Heiden association: Deep, moderately well drained to well drained, gently sloping to moderately steep, clayey soils on uplands

4 Patilo-Arenosa association: Deep, well drained to moderately well drained, gently sloping to sloping, sandy soils on uplands

5 Sunev-Seguin association: Deep, well drained, nearly level to gently sloping, loamy soils on bottom lands and terraces

6 Austin-Eddy association: Moderately deep to very shallow, well drained, gently sloping, clayey to gravelly loamy soils on uplands

Compiled 1975

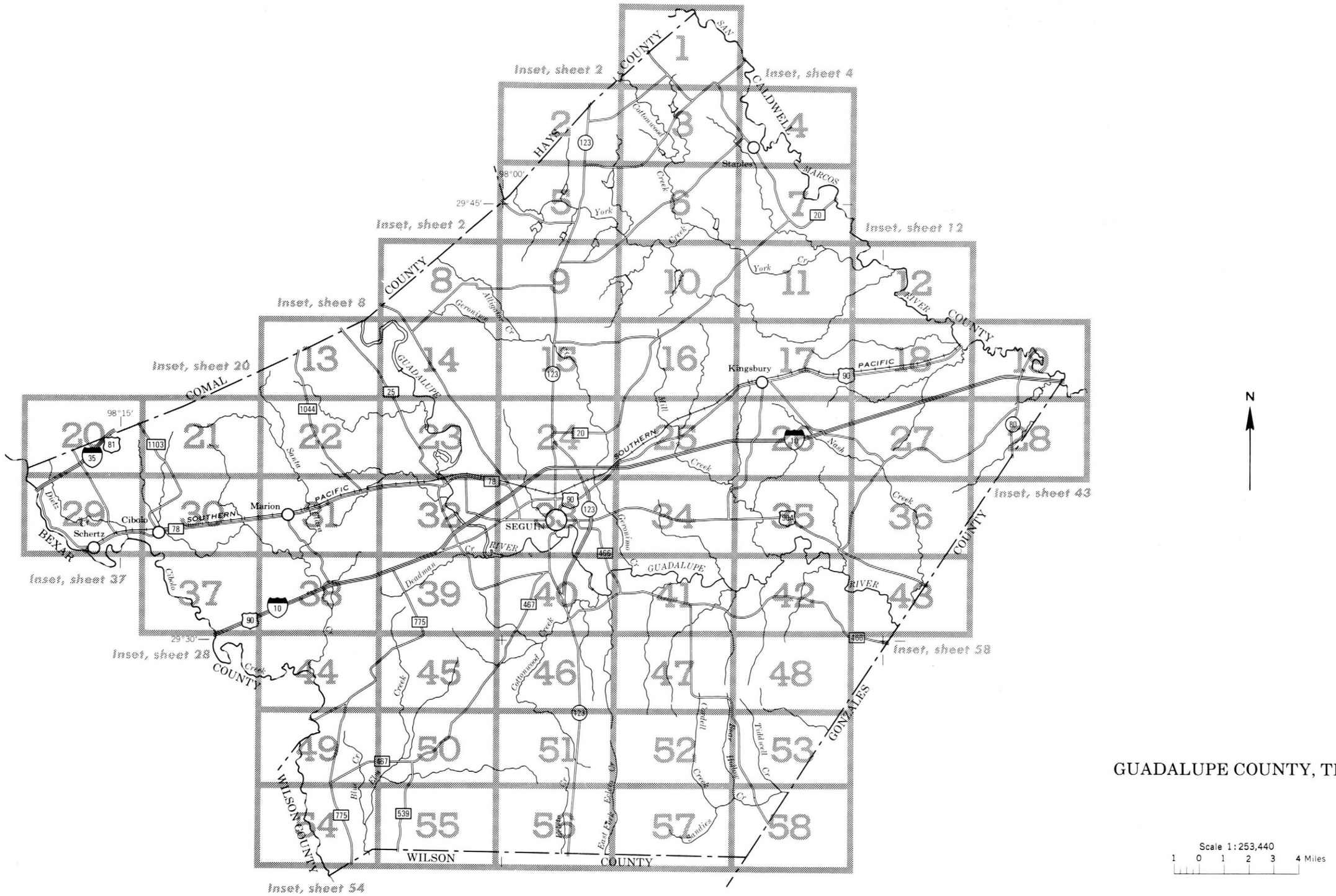
N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
GUADALUPE COUNTY, TEXAS

Scale 1:253,440
1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.


Inset, sheet 2
Inset, sheet 4
Inset, sheet 2
Inset, sheet 12
Inset, sheet 8
Inset, sheet 20
Inset, sheet 43
Inset, sheet 37
Inset, sheet 28
Inset, sheet 58
Inset, sheet 54
HAYS COUNTY
CALDWELL COUNTY
COMAL COUNTY
BEXAR COUNTY
WILSON COUNTY
GONZALES COUNTY
RIVER COUNTY
WILSON COUNTY
Staples
Kingsbury
Marion
Cibolo
Schertz
SEGUIN
PACIFIC
SOUTHERN
GUADALUPE RIVER
98°00′
98°15′
29°45′
29°30′
N
GUADALUPE COUNTY, TEXAS
Scale 1:253,440
1 0 1 2 3 4 Miles

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit (G.P.)
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; id)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (CeA; FoB2)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, shows the slope. Symbols without a slope letter are those for nearly level soils. A final number, 3 or 4, in the symbol shows that the soil is eroded or severely eroded.

SYMBOL	NAME
AlC3	Altoga silty clay, 3 to 5 percent slopes, eroded
AlE3	Altoga silty clay, 5 to 12 percent slopes, eroded
ArD	Arenosa fine sand, 1 to 8 percent slopes
AuB	Austin silty clay, 1 to 3 percent slopes
AuC3	Austin silty clay, 3 to 5 percent slopes, eroded
BaA	Barbarosa silty clay, 0 to 1 percent slopes
BaB	Barbarosa silty clay, 1 to 3 percent slopes
Bo	Bosque and Seguin soils, frequently flooded
BrA	Branyon clay, 0 to 1 percent slopes
BrB	Branyon clay, 1 to 3 percent slopes
BuA	Burleson caly, 0 to 1 percent slopes
ByA	Burleson gravelly clay, 0 to 1 percent slopes
ByB	Burleson gravelly clay, 1 to 3 percent slopes
CfA	Crockett fine sandy loam, 0 to 1 percent slopes
CfB	Crockett fine sandy loam, 1 to 3 percent slopes
CgC	Crockett gravelly sandy loam, 1 to 5 percent slopes
CsC3	Crockett loam, 2 to 5 percent slopes, eroded
CsD4	Crockett loam, 3 to 8 percent slopes, severely eroded
DgE	Darst very gravelly sandy loam, 5 to 10 percent slopes
DmC	Demona loamy fine sand, 1 to 5 percent slopes
DoB	Doss silty clay, 1 to 3 percent slopes
EgC	Eddy gravelly clay loam, 3 to 5 percent slopes
FhF3	Ferris and Heiden soils, 5 to 20 percent slopes, eroded
HeB	Heiden clay, 1 to 3 percent slopes
HeC	Heiden clay, 3 to 5 percent slopes
HeC3	Heiden clay, 3 to 5 percent slopes, eroded
HeD3	Heiden clay, 5 to 8 percent slopes, eroded
HoA	Houston Black clay, 0 to 1 percent slopes
HoB	Houston Black clay, 1 to 3 percent slopes
HpB	Houston Black gravelly clay, 1 to 3 percent slopes
HpC	Houston Black gravelly clay, 3 to 5 percent slopes
LeA	Lewisville silty clay, 0 to 1 percent slopes
LeB	Lewisville silty clay, 1 to 3 percent slopes
MaA	Mabank loam, 0 to 1 percent slopes
MaB	Mabank loam, 1 to 3 percent slopes
MaB3	Mabank loam, 1 to 3 percent slopes, eroded
NcF	Nebgen-Jedd complex, 3 to 20 percent slopes
PaD	Patilo and Arenosa soils, 1 to 8 percent slopes
QeC	Queeny gravelly loam, 1 to 5 percent slopes
QeF	Queeny gravelly loam, 5 to 20 percent slopes
QgC	Quihi soils, 1 to 5 percent slopes
Se	Seguin silty clay loam
SuA	Sunev loam, 0 to 1 percent slopes
SuB	Sunev loam, 1 to 3 percent slopes
SuC3	Sunev loam, 3 to 5 percent slopes, eroded
Tr	Trinity clay
Tw	Trinity clay, frequently flooded
Uh	Uhland fine sandy loam, occasionally flooded
Uw	Uhland soils, frequently flooded
VrC	Vernia very gravelly loamy sand, 1 to 5 percent slopes
WdB	Windthorst fine sandy loam, 1 to 3 percent slopes
WdC3	Windthorst fine sandy loam, 1 to 5 percent slopes, eroded

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 1

GUADALUPE COUNTY, TEXAS NO. 1

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 345 000 FEET

735 000 FEET

725 000 FEET

HAYS COUNTY

CALDWELL COUNTY

SAN MARCOS

Cottonwood Creek

Redwood

(Joins inset B, sheet 2)

(Joins sheet 3)

2 365 000 FEET

(Joins inset A, sheet 2)

N

1 Mile

5000 Feet

Scale 1:20000

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 2

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 2

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 3

GUADALUPE COUNTY, TEXAS NO. 3

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 345 000 FEET

720 000 FEET

(Joins sheet 1)

(Joins sheet 2)

(Joins sheet 4)

(Joins sheet 6)

2 365 000 FEET

710 000 FEET

Redwood

Cottonwood Creek

Site 14

Site 15

SAN MARCOS RIVER

CALDWELL COUNTY

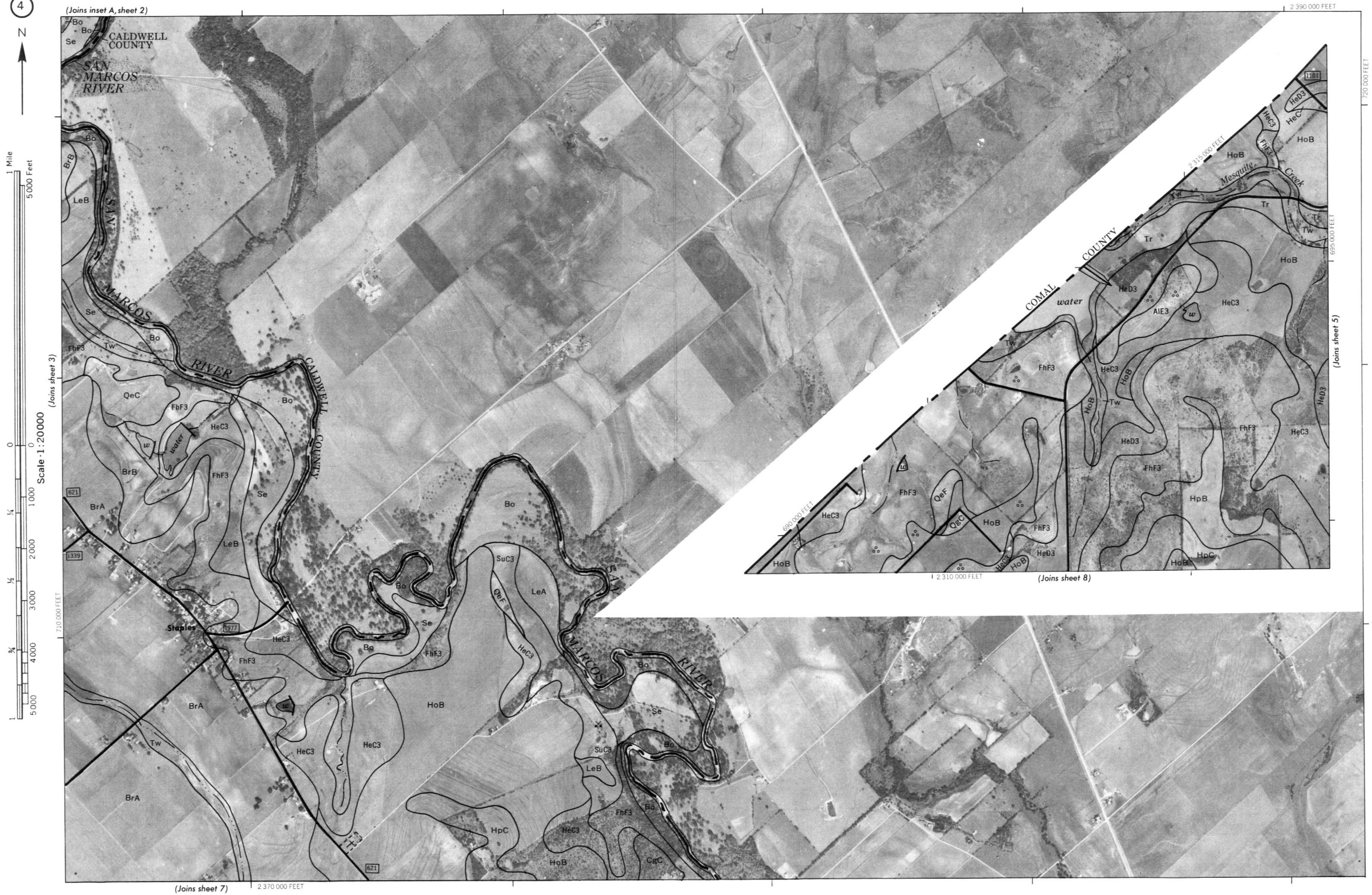
3

N

1 Mile

5,000 Feet

Scale 1:20000



GUADALUPE COUNTY, TEXAS — SHEET NUMBER 5

GUADALUPE COUNTY, TEXAS NO. 5

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 320 000 FEET

705 000 FEET

(Joins sheet 2)

(Joins inset, sheet 4)

(Joins sheet 6)

(Joins sheet 9)

690 000 FEET

2 340 000 FEET

HAYS COUNTY

COMAL COUNTY

Site 6 Site 7 Site 8 Site 9 Site 10

Creek York Mesquite Long Zorn

1 Mile 5000 Feet

Scale 1:20000

N

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 6

(Joins sheet 3)

2 365 000 FEET

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

(Joins sheet 5)

705 000 FEET

690 000 FEET

(Joins sheet 7)

(Joins sheet 10)

2 345 000 FEET

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 6

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 7

7

N

(Joins sheet 4)

2 370 000 FEET

7105 000 FEET

(Joins sheet 6)

(Joins sheet 11)

2 390 000 FEET

690 000 FEET

(Joins inset, sheet 12)

CALDWELL COUNTY

MARCOS RIVER

York Creek

621

20

1 Mile

5000 Feet

Scale · 1:20000

GUADALUPE COUNTY, TEXAS NO. 7

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

8

N

1 Mile 5000 Feet

0 0

Scale 1:20000

¼ 1000

½ 2000

¾ 4000

1 5000

2 292 000 FEET

677 000 FEET

670 000 FEET

2 287 000 FEET

(Joins sheet 13)

(Joins lower left)

3000 AND 5000-FOOT GRID TICKS

(Joins inset, sheet 4)

2 315 000 FEET

685 000 FEET

675 000 FEET

(Joins inset)

2 295 000 FEET

(Joins sheet 14)

(Joins sheet 9)

COMAL COUNTY

LAKE DUNLAP

Alligator Creek

Geronimo Creek

New Braunfels Municipal Airfield

Clear Springs

Barbaroso

BaA BaB BrA BrB FhF3 HeC HeC3 HeD3 HoB HpB HpC LeA LeB OgC QeC QeF SuA SuB SuC3 Tr Tw AlE3

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 8

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 9

9

N

2 320 000 FEET

(Joins sheet 5)

685 000 FEET

(Joins sheet 8)

(Joins sheet 10)

675 000 FEET

(Joins sheet 15)

2 340 000 FEET

Harborth Hill

Alligator Creek

water
Site 11

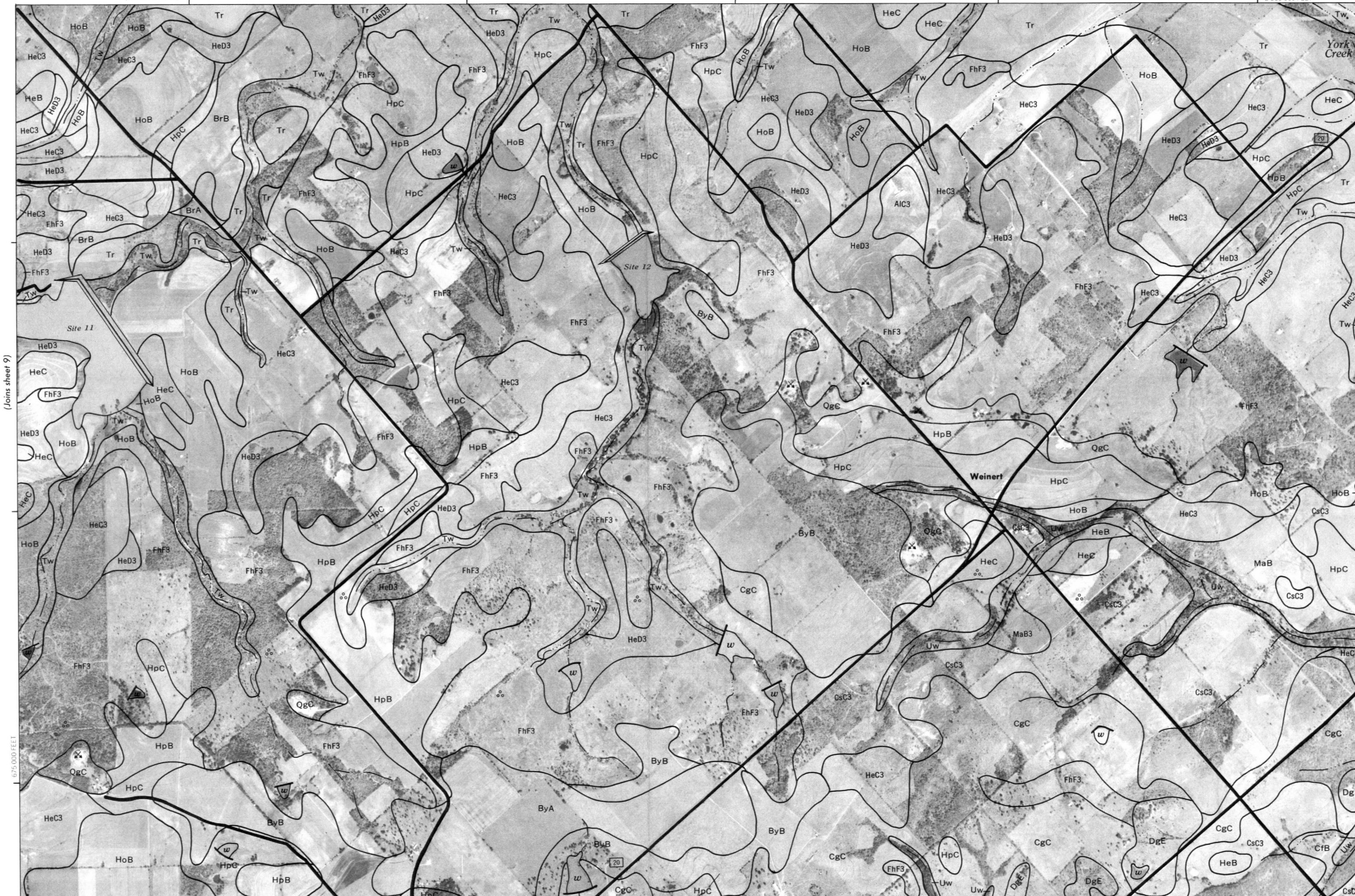
1 Mile
5000 Feet
Scale 1:20000

GUADALUPE COUNTY, TEXAS NO. 9

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(10)

N



Scale 1:20000

1 Mile — 5000 Feet

0 — ¼ — ½ — ¾ — 1 Mile

0 — 1000 — 2000 — 3000 — 4000 — 5000 Feet

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 11

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 370 000 FEET

685 000 FEET

(Joins sheet 7)

(Joins sheet 10)

(Joins sheet 12)

(Joins sheet 17)

2 390 000 FEET

675 000 FEET

CALDWELL COUNTY

SAN MARCOS RIVER

York Creek

Brushy Creek

11

N

1 Mile

5000 Feet

Scale 1:20000

0 0 ¼ 1000 2000 ½ 3000 4000 ¾ 5000 1

N

Scale 1:20000

1 Mile
5000 Feet
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 13

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 270 000 FEET

670 000 FEET

(Joins inset, sheet 8)

(Joins inset, sheet 20)

(Joins sheet 14)

(Joins sheet 22)

2 290 000 FEET

660 000 FEET

COMAL COUNTY

DUNLAP LAKE

GRAVEL PIT

Schumansville

1044

725

13

N

1 Mile

5000 Feet

Scale 1:20000

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 14

14

N

Scale 1:20000

1 Mile 5000 Feet

(Joins sheet 8)

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 23)

2 315 000 FEET

2 295 000 FEET

670 000 FEET

660 000 FEET

LAKE DUNLAP

Clear Springs

Geronimo Creek

GUADALUPE RIVER

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY TEXAS NO. 14

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 15

15

N

2 320 000 FEET

670 000 FEET

(Joins sheet 9)

(Joins sheet 14)

(Joins sheet 16)

(Joins sheet 24)

2 340 000 FEET

660 000 FEET

Alligator Creek

Geronimo Creek

Geronimo

Scale 1:20000

1 Mile 0 1/4 1/2 3/4 1

5 000 Feet 0 1 000 2 000 3 000 4 000 5 000

GUADALUPE COUNTY, TEXAS NO. 15

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 16

N

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

Scale 1:20000

1 Mile ¾ ½ ¼ 0 1

5000 Feet 4000 3000 2000 1000 0 5000

GUADALUPE COUNTY, TEXAS NO. 17

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

18

N

(Joins sheet 12)

2 415 000 FEET

670 000 FEET

(Joins sheet 17)

(Joins sheet 19)

660 000 FEET

(Joins sheet 27)

2 395 000 FEET

Scale 1:20000

1 Mile 5000 Feet

0 0 ¼ 1000 ½ 2000 ¾ 3000 1 4000 5000

CsC3 MaB CfB GsC3 DmC WdC3 CsD4 CfA BrB Se Bo Tr LeB PaD NcF DgE VrC Uw Uh FhF3 MaB3 water

Wolf Creek

CALDWELL COUNTY

GUADALUPE COUNTY

SAN MARCOS RIVER

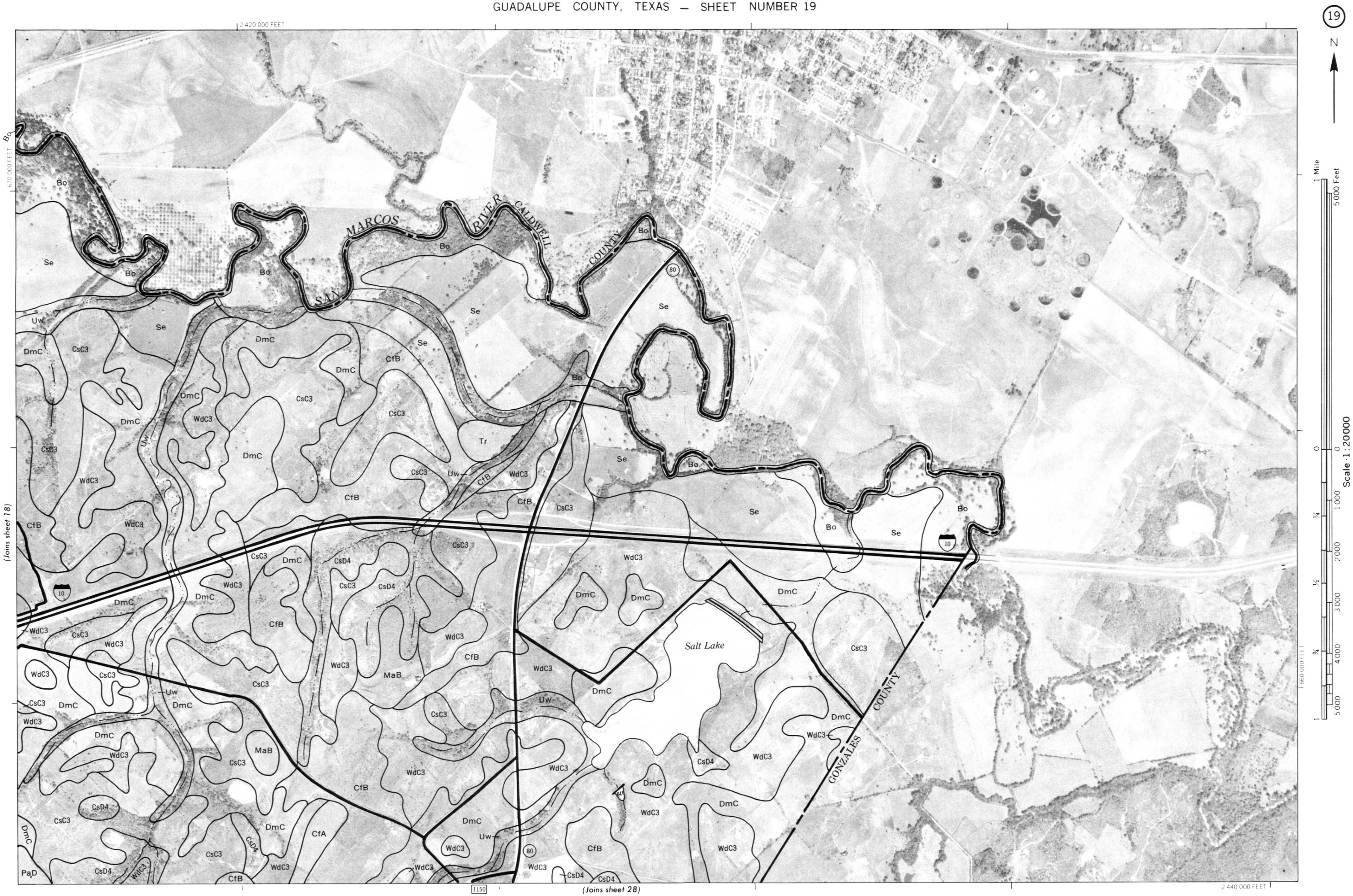
Highsmith Creek

PACIFIC SOUTHERN

90 10

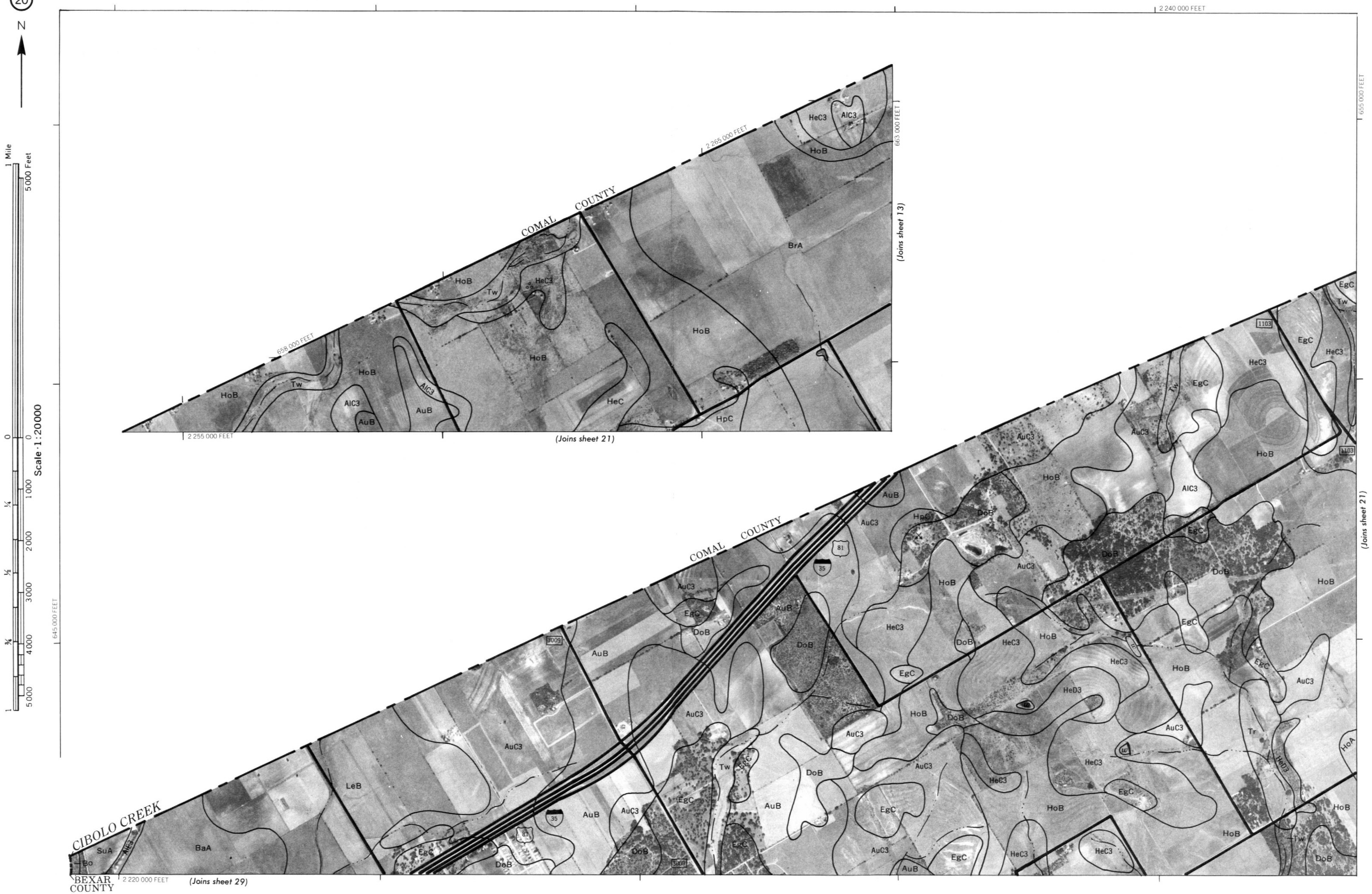
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 18



GUADALUPE COUNTY, TEXAS NO. 19

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 21

21

2 245 000 FEET

655 000 FEET

(Joins inset, sheet 20)

(Joins sheet 20)

(Joins sheet 22)

(Joins sheet 30)

2 265 000 FEET

645 000 FEET

COMAL COUNTY

Santa Clara Creek

N

1 Mile

5000 Feet

Scale 1:20000

GUADALUPE COUNTY, TEXAS NO. 21

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 22

N

Scale 1:20000

1 Mile · ¾ · ½ · ¼ · 0

5000 Feet · 4000 · 3000 · 2000 · 1000 · 0

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 23

GUADALUPE COUNTY, TEXAS NO. 23

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 295 000 FEET

655 000 FEET

(Joins sheet 14)

(Joins sheet 24)

(Joins sheet 22)

(Joins sheet 32)

2 315 000 FEET

645 000 FEET

23

N

Scale 1:20000

1 Mile

5000 Feet

GUADALUPE RIVER

LAKE McQUEENEY

Treasure Island

McQueeney

SOUTHERN PACIFIC

Tong Creek

Youngs Creek

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 24

(Joins sheet 15)

(Joins sheet 23)

(Joins sheet 25)

(Joins sheet 33)

N

Scale 1:20000

1 Mile

5000 Feet

0 1000 2000 3000 4000 5000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 25

GUADALUPE COUNTY, TEXAS NO. 25

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 345 000 FEET

655 000 FEET

645 000 FEET

2 365 000 FEET

(Joins sheet 16)

(Joins sheet 24)

(Joins sheet 26)

(Joins sheet 34)

25

N

1 Mile

5000 Feet

Scale 1:20000

PACIFIC SOUTHERN

Mill Creek

Long Branch

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 27

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 395 000 FEET

655 000 FEET

(Joins sheet 18)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 36)

2 415 000 FEET

645 000 FEET

27

N

1 Mile

5000 Feet

Scale 1:20000

28

N

1 Mile 5000 Feet

Scale 1:20000

(Joins sheet 19)

(Joins sheet 27)

(Joins inset, sheet 43)

(Joins sheet 37)

(Joins sheet 44)

2 440 000 FEET

655 000 FEET

2 265 000 FEET

605 000 FEET

645 000 FEET

600 000 FEET

2 420 000 FEET

2 260 000 FEET

CsC3 CsD4 WdC3 CfA PaD DmC CfB Uw Uh SuA SuB SuC3 LeA LeB BaA AlB2 Se Bo

Creek Smith GONZALES COUNTY BEXAR COUNTY

Zuehl Air Force Auxiliary Field

Zuehl

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 28

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 29

29

N

2 220 000 FEET

640 000 FEET

(Joins sheet 20)

(Joins sheet 30)

(Joins inset, sheet 37)

2 240 000 FEET

625 000 FEET

COMAL COUNTY

HEIDEN COUNTY

SCHERTZ

CIBOLO

CIBOLO CREEK

Scale 1:20000

1 Mile 0 5000 Feet

1 000 0 1 000 2 000 3 000 4 000 5 000 Feet

GUADALUPE COUNTY, TEXAS NO. 29

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(30)

N

1 Mile
5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 30

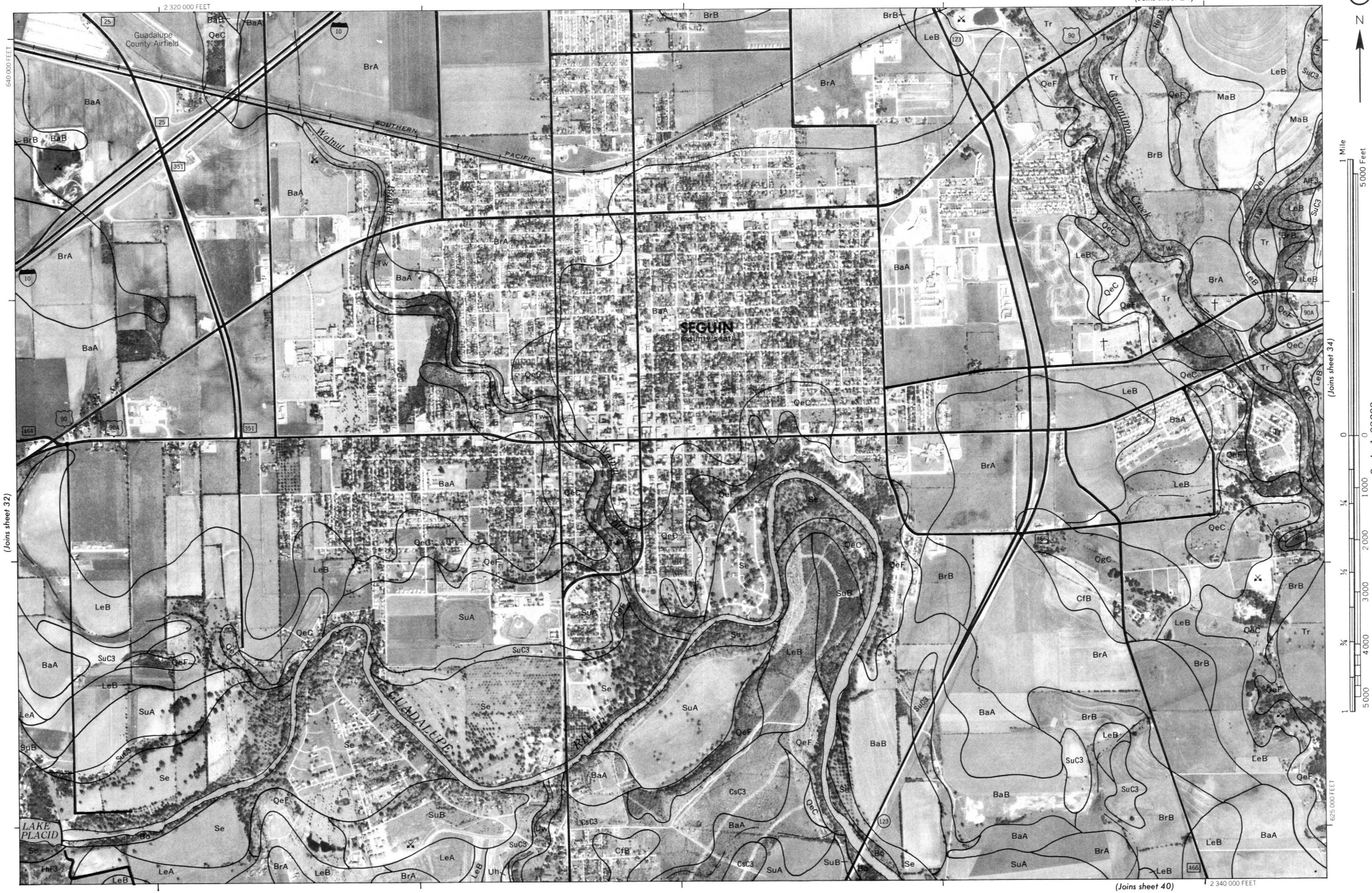
GUADALUPE COUNTY, TEXAS NO. 31

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 32

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 32



GUADALUPE COUNTY, TEXAS NO. 33

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

34

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 34

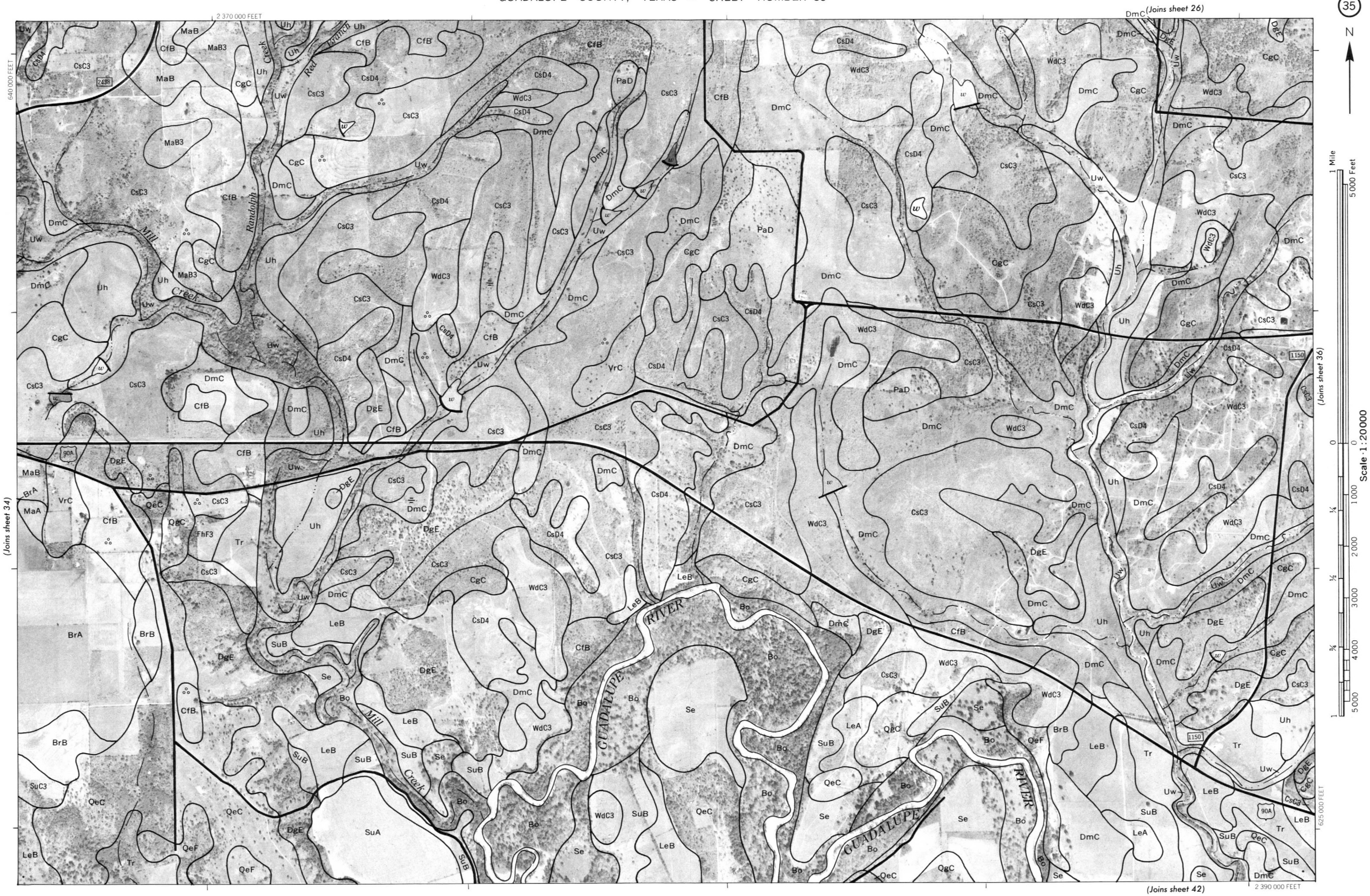
N

Scale 1:20000

1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 34



GUADALUPE COUNTY, TEXAS NO. 35

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 36

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

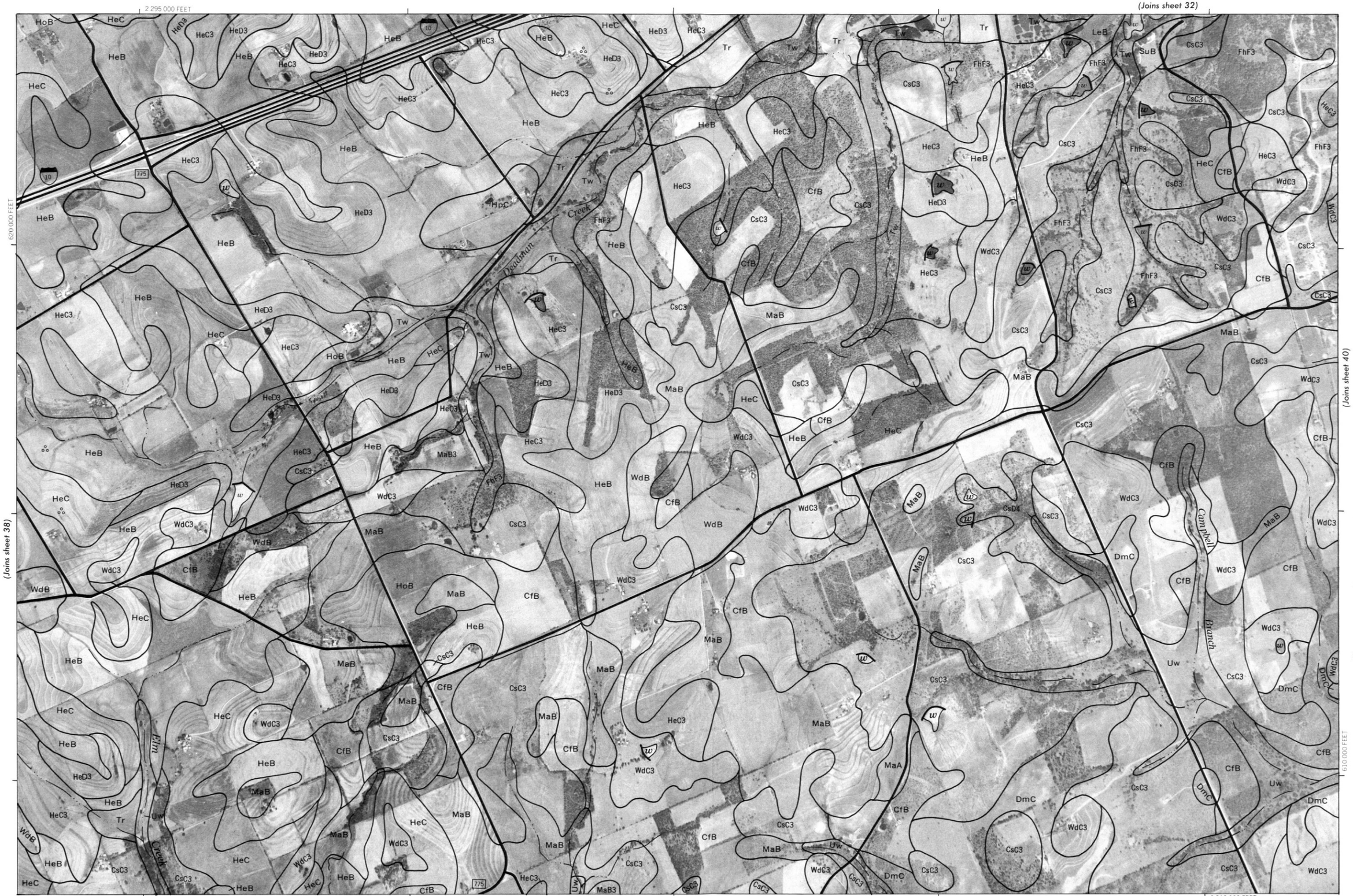
GUADALUPE COUNTY, TEXAS NO. 36

GUADALUPE COUNTY, TEXAS NO. 37
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 38

GUADALUPE COUNTY, TEXAS NO. 39
This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



39

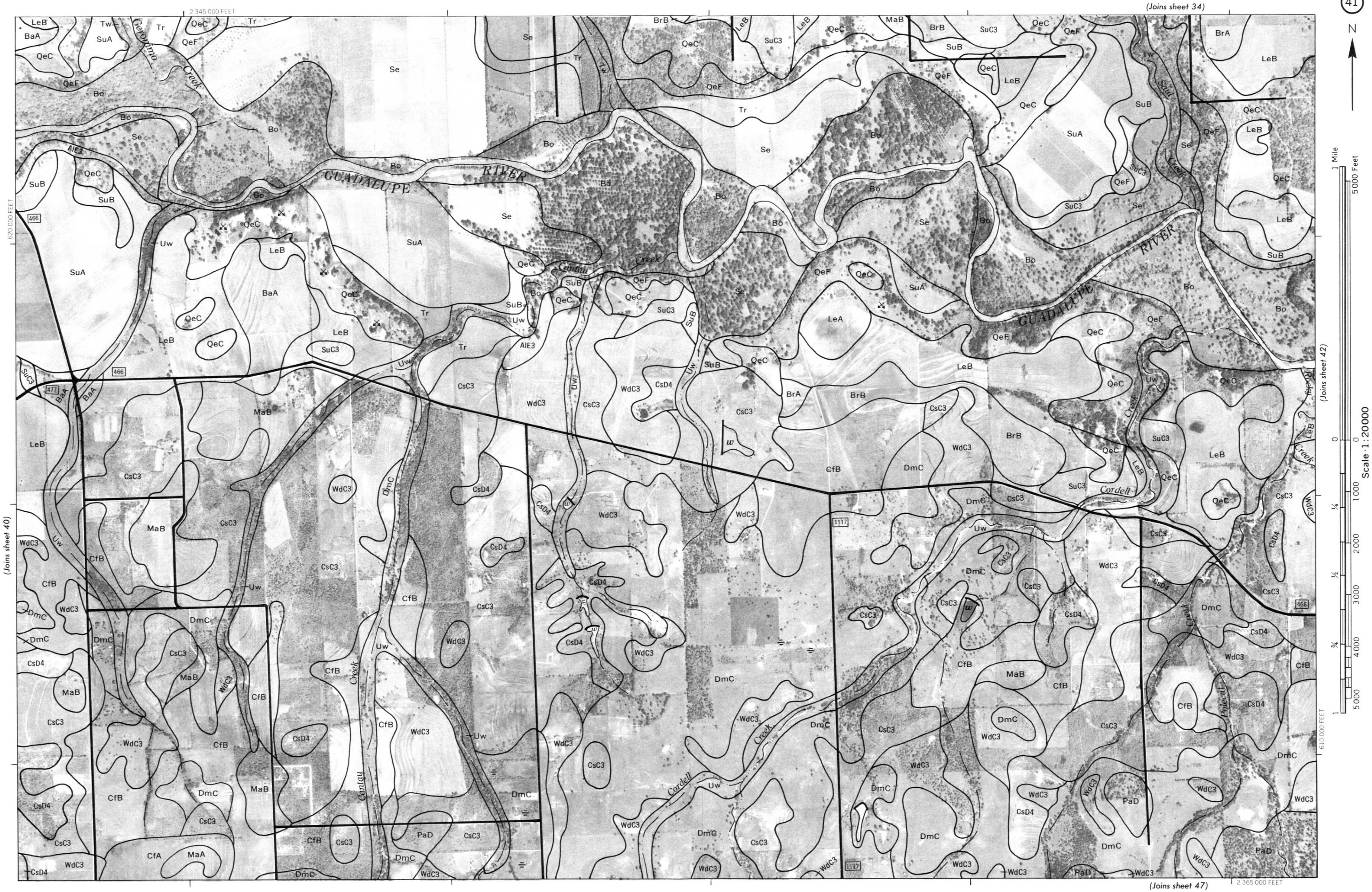
N

1 Mile
5000 Feet
Scale·1:20000
0
1/4
1/2
3/4
1
1000
2000
3000
4000
5000

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 40

GUADALUPE COUNTY, TEXAS NO. 40

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



GUADALUPE COUNTY, TEXAS NO. 41

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 43
This sheet compiled or [illegible] aerial photographs by the U.S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Soil lines, the approximate [illegible]
Coordinate grid ticks and [illegible] are approximately positioned

43

N

1 Mile
5000 Feet

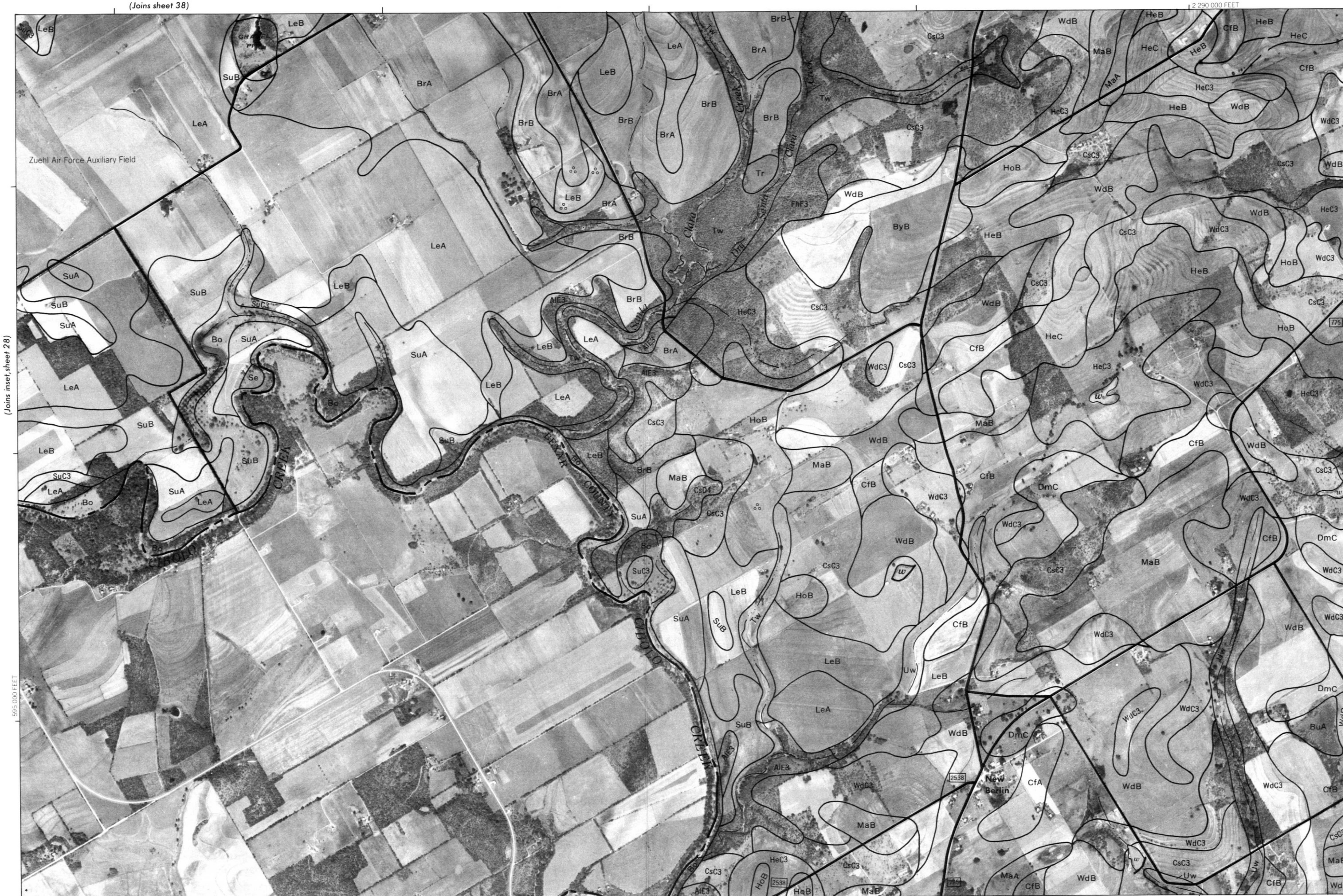
Scale 1:20000
0 1/4 1/2 3/4 1
0 1000 2000 3000 4000 5000

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 44

(44)

N

(Joins sheet 38)



(Joins inset, sheet 28)

(Joins sheet 45)

(Joins sheet 49)

1 Mile
5000 Feet
Scale 1:20000
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 44

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 45

45

N

2 295 000 FEET

(Joins sheet 39)

695 000 FEET

(Joins sheet 44)

(Joins sheet 46)

595 000 FEET

(Joins sheet 50)

2 315 000 FEET

Scale 1:20000

1 Mile

5000 Feet

GUADALUPE COUNTY, TEXAS NO. 45

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

46

N

(Joins sheet 40)

2 340 000 FEET

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 45)

595 000 FEET

(Joins sheet 51)

2 320 000 FEET

665 000 FEET

(Joins sheet 47)

Elm Creek

Cottonwood Creek

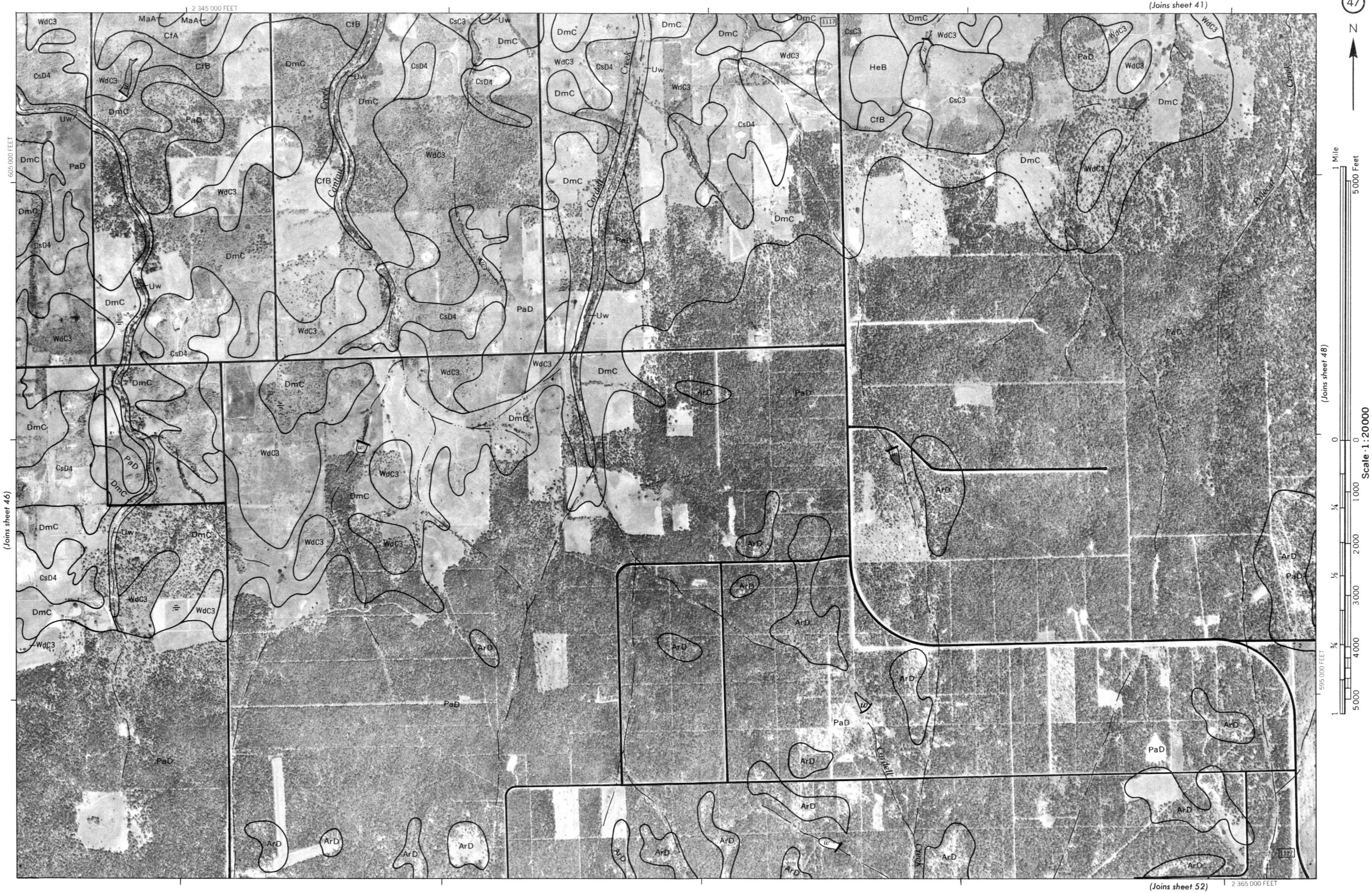
Kunde Branch

Krums Creek

This map is compiled on 1971 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 46

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



48

N

(Joins sheet 42)

2 390 000 FEET

605 000 FEET

(Joins sheet 47)

595 000 FEET

(Joins sheet 53)

2 370 000 FEET

(Joins inset, sheet 58)

Scale 1:20000

1 Mile

5 000 Feet

Rabb Creek

Salt Creek

Capote Hills

Tidwell Creek

O'Neal Creek

GONZALES COUNTY

WdC3

DmC

NcF

ArD

PaD

1117

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 48

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 49

49

N

(Joins sheet 44)

2 270 000 FEET

590 000 FEET

CIBOLO CREEK

BEXAR COUNTY

WILSON COUNTY

Blue Creek

Elm Creek

(Joins sheet 50)

580 000 FEET

(Joins sheet 54)

2 290 000 FEET

1 Mile

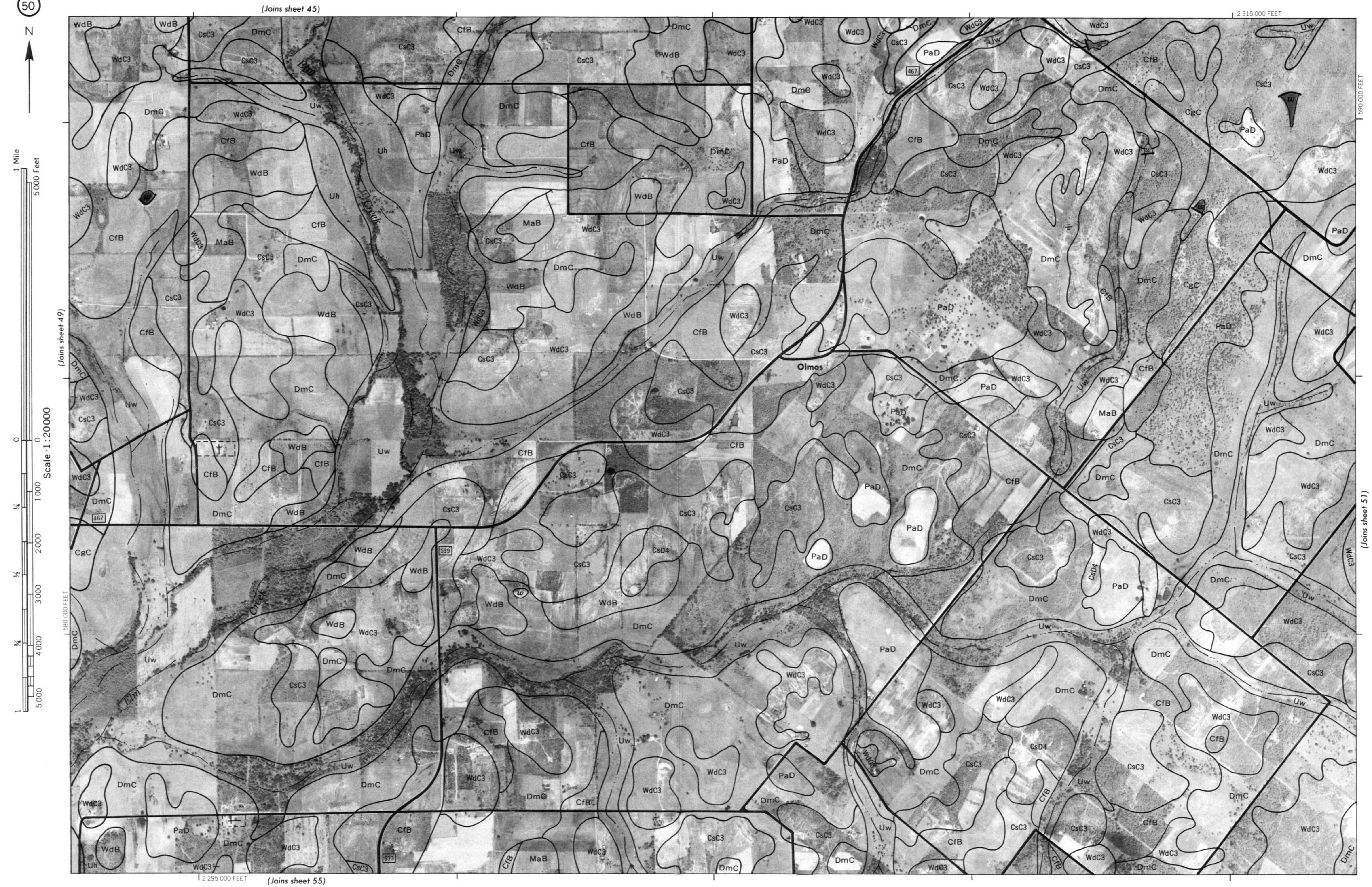
5 000 Feet

Scale 1:20000

GUADALUPE COUNTY, TEXAS NO. 49

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 50



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 50

GUADALUPE COUNTY, TEXAS NO. 51

This map is compiled on 1971 aerial photographs by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

2 320 000 FEET

5 980 000 FEET

(Joins sheet 46)

(Joins sheet 50)

(Joins sheet 52)

(Joins sheet 56)

2 340 000 FEET

51

N

1 Mile

5000 Feet

Scale 1:20000

0 ¼ ½ ¾ 1

0 1000 2000 3000 4000 5000

Cottonwood Creek

water

52

N

(Joins sheet 47)

2 365 000 FEET

590 000 FEET

(Joins sheet 51)

(Joins sheet 53)

580 000 FEET

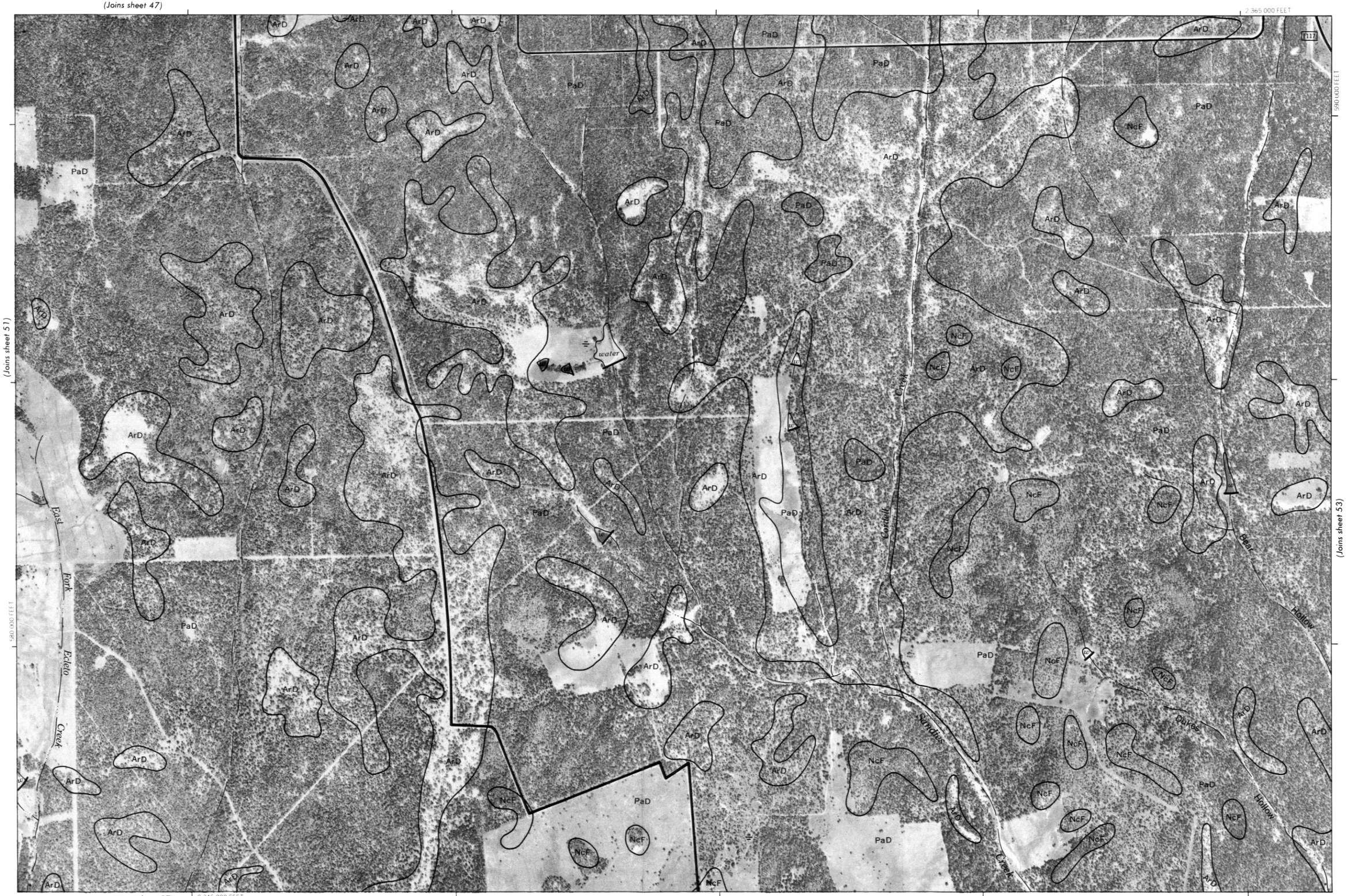
(Joins sheet 57)

2 345 000 FEET

1 Mile 5000 Feet

Scale 1:20000

0 0 ¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 52

GUADALUPE COUNTY, TEXAS NO. 53

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 54

54

N

1 Mile

5000 Feet

Scale 1:20000

(Joins sheet 49)

2 290 000 FEET

575 000 FEET

(Joins sheet 55)

560 000 FEET

2 270 000 FEET

(Joins inset)

CIBOLO CREEK

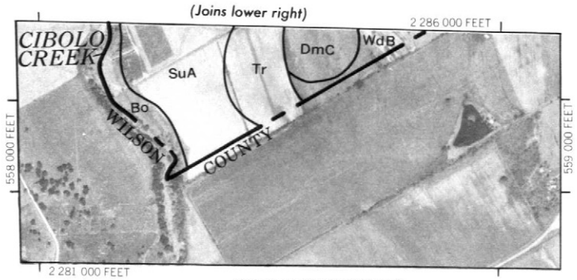
WILSON COUNTY

Elm Creek

Blue Creek

Uw Creek

Water



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 54

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 55

55

GUADALUPE COUNTY, TEXAS NO. 55

This map is compiled on 1972 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and lake division corners, if shown, are approximately positioned.

2 295 000 FEET

575 000 FEET

(Joins sheet 50)

(Joins sheet 54)

(Joins sheet 56)

WILSON COUNTY

2 315 000 FEET

560 000 FEET

N

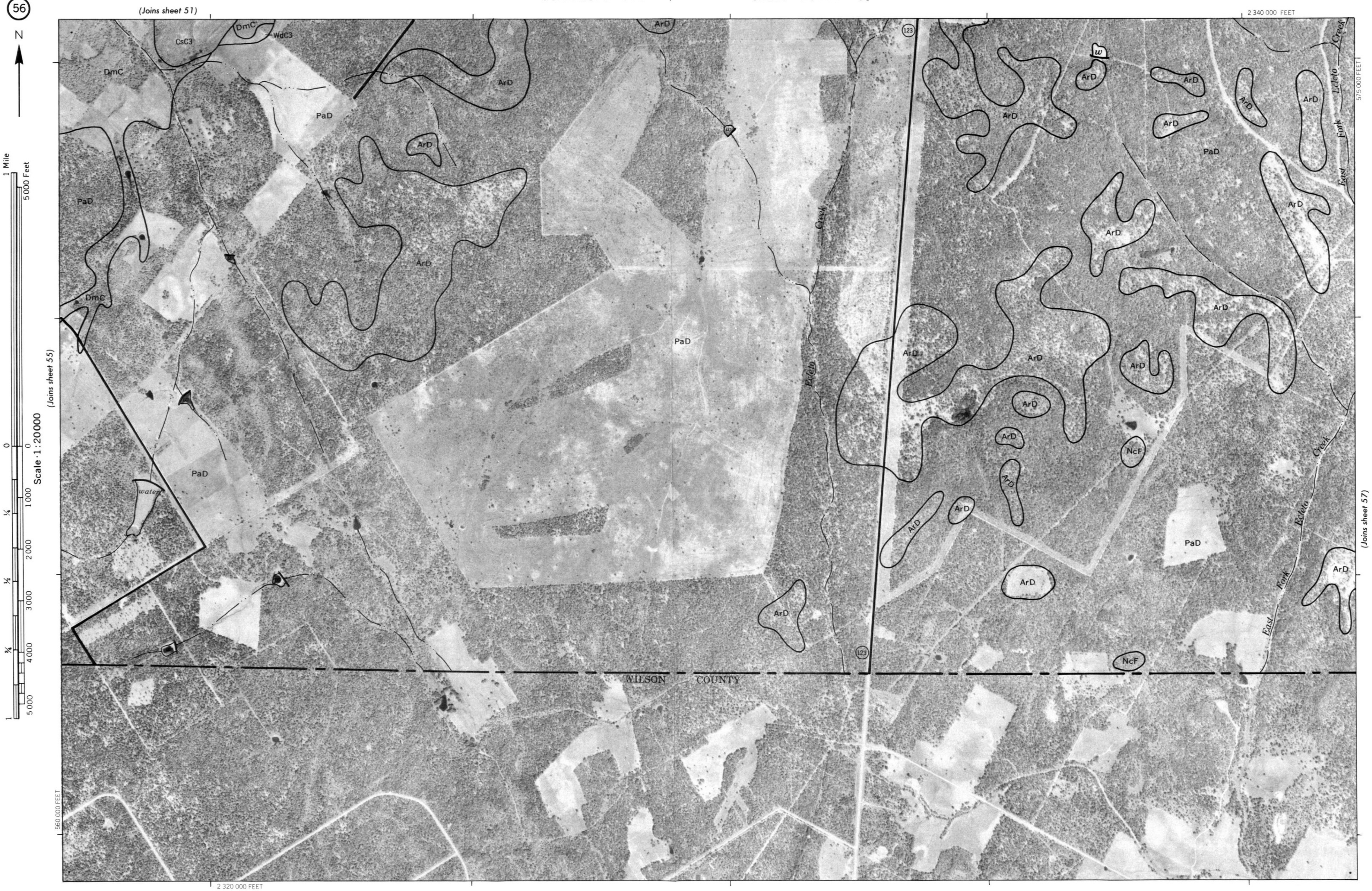
1 Mile 0 5 000 Feet

Scale 1:20000

0 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

GUADALUPE COUNTY, TEXAS — SHEET NUMBER 56



This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 57

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

58

N

(Joins sheet 53)

(Joins sheet 57)

(Joins sheet 48)

(Joins sheet 43)

2 390 000 FEET

2 397 000 FEET

575 000 FEET

605 000 FEET

595 000 FEET

2 392 000 FEET

560 000 FEET

2 370 000 FEET

Scale 1:20000

1 Mile 5 000 Feet

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1¼ 5 000

Sandies Creek

GONZALES COUNTY

WILSON COUNTY

1117

466

Tw

PaD

NcF

ArD

DmC

WdC3

CfB

w

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture. Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GUADALUPE COUNTY, TEXAS NO. 58